

PROJECT MANUAL SPECIFICATIONS

MURANO THREE OAKS APARTMENTS LEE COUNTY, FL

DATE: 01/02/2019

Forum No.: 3669

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(Additional copies available from the Owner’s Geotechnical Eng.)

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work by Owner.
 - 4. Access to site.
 - 5. General Conditions and Supplemental Conditions.

1.3 PROJECT INFORMATION

- A. Project Identification: Project name and location is indicated on the Contract Documents.
- B. Owner: As indicated on the Contract Documents.
- C. Architect: **Forum Architecture & Interior Design, Inc.**
- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
 - 1. Structural Engineer.
 - 2. Plumbing, Mechanical, and Electrical Engineer.
- E. Owner's Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:
 - 1. Civil Engineer.
 - 2. Geotechnical Engineer.
 - 3. Landscape Architect.
 - 4. Interior Designer.
- F. Contractor: The General Contractor has been engaged or shall be selected by the Owner for this Project.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work for this Project includes providing all labor and materials required for the complete construction and finish for this Project. The Work is defined by the Contract Documents as directed by the Owner.

1. Site development, landscaping/hardscaping, and other site improvements are also required and are documented and specified by the Owner's Civil Engineer and Landscape/Hardscape Architect.
2. The Work shall comply with all recommendations and procedures contained in the Geotechnical Exploration Report, prepared by the Owner's Geotechnical Engineer. A copy is included for reference at the end of this Project Manual Specifications. The Contractor shall contact the Geotechnical Engineer to confirm if the report is complete and final. Additional or revised copies shall be provided by the Geotechnical Engineer.
3. The Project has been designed to comply with the applicable Building and Fire Codes as indicated on the Drawings.
4. The Project has been designed to comply with the applicable accessibility requirements as indicated on the Drawings.
5. The Contractor shall be responsible for complying with all applicable codes and accessibility requirements and must notify the Architect of any discrepancies indicated by these documents during bidding and prior to proceeding with the work.
6. All trades must review all construction documents and are responsible for all work associated with their trades in these documents and shall coordinate and sequence their work with other trades. Do not base scope of work solely on a review of the sheets typically associated with the trade's scope of work.
7. Drawings may include "Owner's Specifications" for various elements of the Project which may or may not conflict with the Project Manual Specifications. Contractor shall review all construction documents and notify architect of any discrepancies prior to proceeding with the work.

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner or Owner's consultants, including but not limited to the Interior Designer.

1.6 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.7 GENERAL CONDITIONS AND SUPPLEMENTAL CONDITIONS

A. General Conditions

1. The General Conditions are intended to be AIA Document A201, General Conditions of the Contract for Construction – 2017 Edition, unless the Owner has their own preferred General Conditions prepared by their legal counsel. Because of copyright laws the A201 is not printed here, but by reference is included as if printed and bound herein. Copies of the A201 may be viewed at the Architect's office or purchased from the American Institute of Architects. Copies of any Owner preferred General Conditions, shall be available from the Owner.

B. Supplemental Conditions

1. Supplemental Conditions, if any, shall be prepared by the Owner and their legal counsel and shall be available from the Owner.

END OF SECTION 011000

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

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

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Limited electronic copies of CAD Drawing Files of the Contract Drawings will be provided by Architect for the General Contractor's use in preparing submittals.

1. The Architect shall only provide electronic copies of CAD Drawing Files of the Architectural "Base File(s)" along with any supporting files.
 2. All electronic copies shall be issued with the Architect's "CAD FILE DISCLAIMER".
 3. The Architect's consultant's electronic CAD Drawing Files for structural, fire protection, plumbing, mechanical, electrical, etc. will not be provided by the Architect.
 4. The Architect shall provide the General Contractor a PDF copy of the complete set of Contract Drawings.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
- C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow **15** working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow **10** working days for review of each resubmittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name of manufacturer.
 - g. Submittal number or other unique identifier, including revision identifier.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Location(s) where product is to be installed, as appropriate.
 - k. Other necessary identification.
 3. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
 4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 5. Transmittal for Paper Submittals: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
 6. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the

Contract Documents, including minor variations and limitations. Include same label information as related submittal.

- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or other electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked "No Exceptions Taken" or "Reviewed As Noted".
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals with mark indicating "No Exceptions Taken" or "Reviewed As Noted," taken by Architect and marked "Issue For Construction".

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- B. Procedure for Electronic Submittals:
 1. Post electronic submittals as PDF electronic files directly to an electronic file sending service specifically established for Project or as otherwise directed by the Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Electronic submittals may be submitted via email as PDF electronic files unless size of file prohibits this method, or as otherwise directed by the Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 4. The Architect shall email the General Contractor and Owner confirming the date that the submittal was received by the Architect.
- C. Procedure for Paper Submittals:
 1. Action Submittals: Submit six (6) paper copies of each submittal unless otherwise indicated. Architect will return four (4) copies.
 2. Informational Submittals: Submit two (2) paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a notarized statement on original paper copy certificates and certifications where indicated.

- D. **Product Data:** Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Compliance with specified referenced standards.
 - g. Testing by recognized testing agency.
 - h. Application of testing agency labels and seals.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
- E. **Shop Drawings:** Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. **Preparation:** Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Schedules.
 - f. Design calculations.
 - g. Compliance with specified standards.
 - h. Seal and signature of professional engineer if specified.
 - i. **Wiring Diagrams:** Differentiate between manufacturer-installed and field-installed wiring.
 2. **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 **24 by 36 inches**.
- F. **Samples:** Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. **Identification:** Attach label on unexposed side of Samples that includes the following:

- a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three (3) sets of Samples. Architect will retain one (1) Sample set; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) paper copies of certificate, signed and

sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

2.3 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 1. Submit electronic or paper copies as indicated in submittal procedures.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- D. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- E. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- F. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- G. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- H. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Preparation of substrates.
- I. Material Safety Data Sheets (MSDSs): Submit information directly to Owner, if requested by Owner; do not submit to Architect.
 1. Architect will not review MSDSs for any submittal and will return all MSDSs without review.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Contractor shall review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. **Mark with approval stamp before submitting to Architect.**
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S/ ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp on each submittal or attach the Architect's "Shop Drawing Review Comments" sheet to each submittal and will mark appropriately to indicate action taken.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- F. Submittals which have not been stamped as reviewed and approved by the Contractor will be returned without review.

END OF SECTION 013300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.3 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS – TO OWNER

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS – TO OWNER

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals to Owner specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals to Owner specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals to Owner specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records to Owner and Architect.
 - 6. Submit changeover information to Owner related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 - 6. Advise Owner of changeover in heat and other utilities.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment.
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements to Owner.
 4. Submit pest-control final inspection report to Owner.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES – TO OWNER

- A. Time of Submittal: Submit written warranties on request of Owner for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark 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 Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-

obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.

- k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation manuals for systems, subsystems, and equipment.
 - 2. Maintenance manuals for the care and maintenance of products, materials, finishes, systems, and equipment.
 - a. Maintenance manuals shall provide a detailed schedule on an ongoing basis of the specific requirements of those building systems, products, and/or assemblies used in the Project.
 - b. Maintenance manuals shall include, but not be limited to, the following:
 - 1) Mechanical, Electrical, and Plumbing systems
 - 2) Conveying systems, where applicable.
 - 3) Structural systems and building components.
 - 4) Doors and windows.
 - 5) Thermal and moisture protection, including caulking and sealants.
 - 6) Roofing.
 - 7) Exterior cladding components and related assemblies.
 - 8) Waterproofing.
 - 9) Painting.

1.3 SUBMITTALS – TO OWNER

- A. Final Submittal: Submit one copy of each manual in final form to Owner at least 15 days before final inspection. Owner will return copy with comments within 15 days after final inspection.
 - 1. Correct or modify each manual to comply with Owner's comments. Submit one copy to Owner of each corrected manual within 15 days of receipt of Owner's comments.

1.4 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold **8-1/2-by-11-inch** paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major

components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions.
 2. Operating standards.
 3. Operating procedures.
 4. Operating logs.
 5. Wiring diagrams.
 6. Control diagrams.
 7. Piped system diagrams.
 8. Precautions against improper use.
 9. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 1. Product name and model number.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUAL

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

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and

maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
- E. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- F. **Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. **Product Maintenance Manual:** Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. **Operation and Maintenance Manuals:** Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
1. Do not use original Project Record Documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."
- E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.

1.3 SUBMITTALS

- A. Record Drawings: Submit one copy of the Project's marked-up Record Drawings to Owner.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications to Owner.
- C. Record Product Data: Submit one copy of each Product Data submittal to Owner.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.

- c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
- 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Duct size and routing.
 - h. Locations of concealed internal utilities.
 - i. Changes made by Change Order or Construction Change Directive.
 - j. Changes made following Architect's written orders.
 - k. Details not on the original Contract Drawings.
 - l. Field records for variable and concealed conditions.
 - m. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 - 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 - 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."

- d. Name of Architect.
- e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 - 5. Note related Change Orders and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from

deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 032000 – 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. This section specified concrete reinforcement for the following:

1. Concrete Footings.
2. Concrete Slabs-on-grade.
3. Concrete Beams.
4. Concrete & Masonry (CMU) Walls.
5. Concrete Columns.

1.3 SUBMITTALS

- A. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement and accessories. Include special reinforcement required at openings through concrete structures.
- B. Selection of splices: All splices are full tension unless noted otherwise.
 1. Splices which are noted on the drawings to be compression splices shall be furnished by one of the following:
 - a. Compression lap splices in accord with ACI 315.
 - b. Mechanical compression only connectors per ACI 439-3R staggered 1/2 Class "B" lap length and maintaining not less than 1/4 the total tensile capacity of any column face.
 - c. Full penetration welds staggered not less than 18 diameters.
 2. Splices shown on the drawings to be either $.5F_y$ or Class "B" may be furnished by one of the following:
 - a. Class "B" lap splices.
 - b. Class "A" (but not less than compression lap) lap splices staggered not less than one Class "B" lap length, except that this shall not be permitted when shown as class "B" in a location which by design has already accounted for other continuing bars or staggered splices.
 - c. Appropriate mechanical connectors per ACI 439-3R to develop at least 125 percent of specified yield strength (f_y) of the bar.
 - d. Full penetration welds to develop at least 125 percent of specified yield strength (f_y) of the bar.
 3. Unless otherwise noted in the drawings, all reinforcing shall be spliced to develop the

full strength of the bar in either tension or compression. Those splices shall be furnished by one of the following:

- a. Class "B" lap splices.
 - b. Full penetration welds to develop at least 125 percent of specified yield strength (f_y) of the bar.
 - c. Appropriate mechanical connectors per ACI 439-3R to develop at least 125 percent of specified yield strength (f_y) of the bar.
4. Total steel at lap splices shall not exceed 8% for columns or shear wall cores containing the spliced bars. Therefore, all the bars may be lapped at one section for up to 4% steel, 1/2 the bars may be lapped for up to 5.3% steel, and only 1/3 the bar may be lapped for up to 6.0% steel. Above 6% steel, other splice choices shall be used. Where staggered lap splices are used, provide a mixture of bar sizes as appropriate where vertical bar size changes on the drawings.
 5. Where different size bars are lap spliced, the length of splice may be based on the smaller bar size unless there is a larger quantity of the smaller bar size in which case the splice length shall be based on the larger bar.
 6. It shall be the responsibility of the reinforcing detailer to determine the concrete strength at the point of a lap splice, the bar position (top or other), bar spacing, confinement condition based on ties or stirrups or edge condition in order to select the proper lap length.
 7. Increase laps for bundled bars in accord with ACI 318, with number based on total bars in-group including lapped bars.
- C. Detailing of splices: Placing shop drawings shall specifically show all splice lap lengths where they occur. Bar diameter lap tables and references to other charts shall not be considered acceptable.
- D. Staggered laps required: Provide staggered laps in any member where necessary to keep space between bars within splice zone at least 1" or 1 bar diameter clear.
- E. Detailing of bar placement: For any bar other than those placed at an edge condition, between edge condition and/or openings, or any other location where the bar cannot be shifted longitudinally, a dimension shall be shown from an identifiable building grid, wall, or edge to at least one end of the bar.
- F. Congested Areas of Placement: For any conditions which result in bar spacing less than 2 diameters clear or where the placement of bars in one member requires critical templating to permit bar placement in an intersecting member, furnish details of sufficient scale to show clearances, spacing, and arrangements for properly placing those bars.
- G. Accessories: Show at least all accessories, supports, chairs, bolsters, and spacers necessary to complete the installation. Where supports are beyond the scope of CRSI detailing standards and custom designed supports are required, provide engineering calculations demonstrating the capacity of the system.
- H. Flat Plates: Provide not less than 3 separate drawings of each plate separately showing bottom bars, top bars, and accessories.
- I. Welding Submittals: If welding of reinforcing bars is to be included as part of the work,

submit a complete welding procedure specification in accord with AWS D1.4, a certified chemical analysis of the steel to be welded, carbon equivalence calculations in accord with a AWS D1.4, and qualification papers for all welders who will be employed on the project. Welders shall have passed a qualification test within a 12 month period prior to the work or furnish a statement from a testing agency acceptable to Architect that they have observed and/or tested that welder's work under similar requirements within the past six months.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
1. ACI 117 "Tolerances for Concrete Construction and Materials".
 2. ACI 301 "Specifications for Structural Concrete for Buildings"
 3. ACI 315 "Details and Detailing of Concrete Reinforcement".
 4. ACI 318 "Building Code Requirements for Reinforced Concrete".
 5. ACI 439 "Mechanical Connection of Reinforcing Bars".
 6. AWS D1.4 "Structural Welding Code - Reinforcing Steel".
 7. CRSI "Manual of Standard Practice"
 8. CRSI "Placing Reinforcing Bars"
 9. Wire Reinforcement Institute "Manual Standard Practice"
 10. All local applicable building codes.

1.5 SUBSTITUTIONS

- A. Reinforcing Splicing: Splices shown in the drawings shall be considered mandatory for base bid purposes. Alternative methods of providing for splices are available within the constraints of this specification and ACI 318. If alternative splices are desired, the shop drawing submitted shall clearly indicate the change and include authorization by all other subcontractors involved in the change.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIAL

- A. Reinforcing Bars: ANSI/ASTM A615, Grade 60, unless otherwise noted.
- B. Epoxy-Coated Reinforcing Bars: ANSI/ASTM A775.
- C. Form-Saving Splice Connectors: Flanged devices to permit insertion of threaded reinforcing bars into a previously formed face.
- D. Mechanical Connectors and Splice Devices: Proprietary products suitable for the use intended and listed in ACI 439-3R.
- E. Steel Wire: ANSI/ASTM A82, plain, cold-drawn, steel.
- F. Fabricated Deformed Steel Bar Mats: ANSI/ASTM A184.
- G. Welded Steel Wire Fabric: ANSI/ASTM A185.

- H. Deformed Steel Wire: ANSI/ASTM A496.
- I. Welded Deformed Steel Wire Fabric: ANSI/ASTM A497.
- J. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI Class B or Class A as requires acceptable.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
 - 3. Provide custom supports where required to support top layer of mats and other special conditions not provided for within CRSI standards.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. When any reinforcing bar is placed projecting either horizontally or vertically from a given element to subsequently lap with other reinforcing bar, verify that the detailed lap length will be achieved. Report any deviation to the Engineer for correction prior to placing concrete in the first element. Bar projections which result in laps shorter than the detailed laps shall be considered rejected, and corrective measures shall be taken at the direction of the engineer with no additional cost to the project.
- E. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- F. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus 2" and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- G. Provide the Engineer with not less than 48 hours notice prior to commencing any welding of reinforcing bars. Welding of reinforcing bars shall only be permitted under the direct

supervision of the Engineer. Welding of crossing reinforcing bars shall not be permitted. Any bars which have unauthorized or unacceptable welds shall be replaced at no additional cost to the project.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Slabs-on-grade.
 - 3. Concrete toppings (lightweight concrete).
- B. This Section does not specify post-tensioned concrete requirements. Refer to Section 033816, Un-bonded Post-Tensioned Concrete, for requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Refer to Section 032000 for Concrete Reinforcement and refer to Section 033816 for Post-Tensioned Concrete system submittal requirements.
- C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Do not begin concrete production until mixes have been approved. Submittal shall include:
 - 1. Laboratory Test Reports: Submit signed and sealed laboratory test reports for concrete materials as specified, per Chapter 5 of ACI 318.
 - 2. Material Certificates: When permitted by Architect in lieu of laboratory test reports, submit material certificates, signed by supplier and Contractor, certifying that material item complies with or exceeds specified requirements.
 - 3. Certificates of source and gradation analysis of aggregates to be used.
 - 4. All Concrete mix designs shall include a written description indicating where each particular mix is to be placed within the structure.
 - 5. Indicate amounts of mixing water to be withheld for later addition at Project site.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on project personnel qualified as ACI Certified Flatwork Technician and Finisher and a supervisor who is an ACI Certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- 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 each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 318 "Building Code Requirements for Reinforced Concrete."
 - 4. ACI 302.1R-04 Guide for Concrete Floor and Slab Construction.
 - 5. [ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.](#)
 - 6. ACI 305 R-77 (Rev. 1991) Hot Weather Concreting.
 - 7. ACI 306 R-78 (Rev. 1990) Cold Weather Concreting.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. 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.
- B. 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.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.

- C. Deformed-Steel Wire: ASTM A 496.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Synthetic Microfibers: ASTM C1116, Type III, 1.5 inches long, monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, gray.
 - 2. Supplementary Cementitious Materials:
 - a. Fly Ash: ASTM C618, Type F may be used up to a maximum of 25 percent of the total cementitious material content
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size:
 - a. Footings and Slabs-on Grade: 3/4 inches nominal.
 - b. Concrete Toppings: 3/8 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - 3. Combined aggregate gradation for slabs and other concrete elements shall be 8% - 22% for aggregate size (3/4 in.) retained on each sieve below the top size and above the No. 100 sieve.
- C. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

- E. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- F. Specific Performance Admixture: ASTM C 494, Type S.

2.6 WATERSTOPS

- A. General: Contractor to provide and install waterstop to seal concrete joints to prevent moisture penetration. Product type to be manufacturer's standard for profile and dimensions and may be, but not limited to, one of the following:
 - 1. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 2. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.
 - 3. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 4. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete.
 - 5. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745 Class C minimum, ASTM D 1709, not less than **10 mils** thick or better if recommended by the Geotechnical Engineer. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
- A. **Alternate** - Termite/Vapor Barrier: ASTM E 1745 Class C minimum, puncture resistance per ASTM D 4833, **15 mils** thick minimum. Include manufacturer's recommended joint tape, perimeter/edge seal, penetration prevention, and screed system. This eliminates the requirement to provide soil treatment termiticide under the building slab per Division 31, Section 313116.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- D. Water: Potable.
- E. Curing and Sealing Compound (VOC Compliant, 700 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class B, 25% solids content minimum. Moisture loss shall be not more than 0.30 Kg/m² when applied at 300 sq. ft./gal. Manufacturer's certification is required.
- F. Clear Curing and Sealing Compound (350 g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m² when applied at 300 sq. ft./gal. Manufacturer's certification is required.
- G. Curing Compound (Strippable): The compound shall conform to ASTM C309. For use on slabs receiving subsequent applied finishes and where noted on the drawings.

2.9 CONCRETE MIXTURES, GENERAL

- 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.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Admixtures: Use admixtures according to manufacturer's written instructions.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.55.
 - 3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4 inch nominal maximum aggregate size. Do not allow air content of troweled finished floors to exceed 3 percent.
 - 4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
- B. Concrete Toppings: Proportion **light-weight** concrete mixture as follows:
 - 1. Minimum Compressive Strength: **2200** psi at 28 days.
 - 2. Minimum Cementitious Materials Content: 580 lb/cu. yd.
 - 3. Air Content: 7 percent, plus or minus 1.5 percent at point of delivery for **3/8** inch nominal maximum aggregate size. Do not allow air content of troweled finished toppings to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. 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.
- F. 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.
- G. 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.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

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."

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 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 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Penetrations: Seal all penetrations as recommended by the manufacturer.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

- C. Accurately position, support, and secure reinforcement against displacement. 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/D1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. 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.

3.6 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 the Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3.7 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. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- 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.

- 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. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. 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. 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 for three successive days, 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.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 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. Apply to surfaces as indicated on the architectural drawings.
- B. 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.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats 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 restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. 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.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven 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.

3.11 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.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- 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. 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.

5. 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.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - 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/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; 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. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
7. 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.
8. 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.

9. Test results shall be reported in writing to Architect, concrete manufacturer, 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.
10. 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.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete 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/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION 033000

SECTION 033816 - UNBONDED POST-TENSIONED 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 includes the following:
 - 1. Furnishing post-tensioning reinforcement and accessories including non-encapsulated prestressing tendons, pocket formers, support bars, bar chairs, and slab bolsters.
 - 2. Installing post-tensioning tendons.
 - 3. Performing post-tensioning operations including stressing and finishing tendons.
 - 4. Recording tendon elongations and gage pressures.
 - 5. Finishing tendon ends and patching stressing pockets.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings and Calculations: Submit complete post-tension slab system design calculations and shop drawings with details, prepared by or under the supervision of, and signed and sealed by, a registered Professional Engineer, licensed in the State of the authority having jurisdiction. Post-tension slab design drawings to indicate as a minimum the placement, anchorage details and effective forces of tendons that will provide the slab pre-compression levels indicated on the contract documents.
- C. Product certificates.
- D. Field quality-control test reports.
- E. Stressing Records: Filled out by testing agency during stressing operation with the following information recorded:
 - 1. Name of Project.
 - 2. Date of approved installation drawings used for installation and stressing.
 - 3. Floor number and concrete placement area.
 - 4. Date of stressing operation.
 - 5. Weather conditions including temperature and rainfall.
 - 6. Name and signature of inspector.
 - 7. Name of individual in charge of stressing operation.
 - 8. Serial or identification numbers of jack and gage.
 - 9. Date of jack-and-gage calibration certificates.
 - 10. Gage pressure to achieve required stressing force per supplied calibration chart.

11. Tendon identification mark.
12. Calculated tendon elongation.
13. Actual tendon elongation.
14. Actual gage pressure.

1.4 QUALITY ASSURANCE

- A. Delegated Specialty Engineer Qualifications: Professional Engineers, licensed in the State of the authority having jurisdiction, who have not less than five (5) years successful experience including projects of similar or larger scope and complexity.
- B. Specialty Firm Qualifications: Firms which have not less than five (5) years successful experience including projects of similar or larger scope and complexity.
- C. Foreman Qualifications: Person with not less than three (3) years field experience in foreman's capacity on projects of similar or larger scope and complexity.
- D. Installer Qualifications: A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 - Field Fundamentals course or has equivalent verifiable experience and knowledge acceptable to Architect.
 1. Superintendent must have received training from post-tensioning supplier in the operation of stressing equipment to be used on Project.
- E. Manufacturer Qualifications: Fabricating plant certified by PTI.
- F. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 1. Testing Agency Inspector: Personnel performing field inspections and measuring elongations shall have successfully completed PTI's Level 1 - Field Fundamentals course or shall have equivalent qualifications acceptable to Architect.
- G. ACI Publications: Comply with ACI 423.6, "Specification for Unbonded Single Strand Tendons," unless otherwise indicated in the Contract Documents.
- H. Pre-installation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle post-tensioning materials according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Immediately remove damaged components from Project site.

PART 2 - PRODUCTS

2.1 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A 416/A 416M, **Grade 270**, uncoated, 7-wire, low-relaxation, **0.5-inch**-diameter strand.
- B. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion-inhibiting properties specified in ACI 423.6; chemically stable and nonreactive with prestressing steel, non-prestressed reinforcement, sheathing material, and concrete.
- C. Tendon Sheathing: Comply with ACI 423.6.
- D. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements in ACI 423.6 and capable of developing 95 percent of actual breaking strength of strand.

2.2 NONPRESTRESSED STEEL BARS

- A. Support Bars, Reinforcing Bars, Hairpins: ASTM A 615/A 615M, **Grade 60**, deformed. Minimum support bar size is **1/2 inch**.
- B. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening tendons and tendon support bars in place. Manufacture bar supports, according to CRSI's "Manual of Standard Practice," from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. For uncoated bars, use all-plastic or CRSI Class 1 plastic-protected bar supports.

2.3 ACCESSORIES

- A. Pocket Formers: Capable of completely sealing wedge cavity; sized to provide the required cover over the anchorage and allow access for cutting strand tail.
- B. Sheathing Repair Tape: Elastic, self-adhesive, moisture-proof tape with minimum width of **2 inches**, in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.
- C. Anchorage Fasteners: Galvanized-steel nails, wires, and screws used to attach anchorage devices to formwork.

2.4 PATCHING MATERIAL

- A. Patching Material: One component, polymer-modified, premixed patching material containing selected silica aggregates and portland cement, suitable for vertical and overhead application. Do not use material containing chlorides or other chemicals known to be deleterious to prestressing steel or material that is reactive with prestressing steel, anchorage device material, or concrete.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Provide formwork for post-tensioned elements as specified in Division 03 Section "Cast-in-Place Concrete." Design formwork to support load redistribution that may occur during stressing operation. Ensure that formwork does not restrain elastic shortening, camber, or deflection resulting from application of prestressing force.
- B. Do not remove forms supporting post-tensioned elements until tendons have been fully stressed and elongations have been approved by Architect.
- C. Do not place concrete in supported floors until tendons on supporting floors have been stressed and elongations have been approved by Architect.

3.2 NONPRESTRESSED STEEL REINFORCEMENT PLACEMENT

- A. Coordinate placement of non-prestressed steel reinforcement with installation of post-tensioning tendons. Placement of non-prestressed steel reinforcement is specified in Section 033000 "Cast-in-Place Concrete."

3.3 TENDON INSTALLATION

- A. Install tendons according to approved installation drawings and procedures stated in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Tendon Supports: Provide continuous slab bolsters or bars supported on individual high chairs spaced at a maximum of 42 inches o.c. to ensure tendons remain in their designated positions during construction operations and concrete placement.
 - 1. Support tendons as required to provide profiles shown on installation drawings. Position supports at high and low points and at intervals not exceeding 48 inches. Ensure that tendon profiles between high and low points are smooth parabolic curves.
 - 2. Attach tendons to supporting chairs and reinforcement without damaging tendon sheathing.
 - 3. Support slab tendons independent of beam reinforcement.
- C. Maintain tendon profile within maximum allowable deviations from design profile according to ACI 423.6.
- D. Maintain minimum radius of curvature of 480-strand diameters for lateral deviations to avoid openings, ducts, and embedded items. Maintain a minimum of 2 inches of separation between tendons at locations of curvature.
- E. Limit tendon bundles to five tendons. Do not twist or entwine tendons within a bundle. Maintain a minimum distance of 12 inches between center of adjacent bundles.
- F. If tendon locations conflict with non-prestressed reinforcement or embedded items, tendon placement governs unless changes are authorized in writing by Architect. Obtain Architect's approval before relocating tendons or tendon anchorages that interfere with one another.

- G. Deviations in horizontal spacing and location of slab tendons are permitted when required to avoid openings and inserts.
- H. Installation of Anchorage Devices:
 - 1. Place anchorage devices at locations shown on approved installation drawings.
 - 2. Attach pocket formers, intermediate anchorage devices, and stressing-end anchorage devices securely to bulkhead forms. Install stressing-end and intermediate anchorage devices perpendicular to tendon axis.
 - 3. Install tendons straight, without vertical or horizontal curvature, for a minimum of **12 inches** behind stressing-end and intermediate anchorages.
 - 4. Embed intermediate anchorage devices at construction joints in first concrete placed at joint.
 - 5. Minimum splice length in reinforcing bars at anchorages is **24 inches**. Stagger splices a minimum of **60 inches**.
 - 6. Place fixed-end anchorage devices in formwork at locations shown on installation drawings. Support anchorages firmly to avoid movement during concrete placement.
- I. Maintain minimum concrete cover according to ACI 423.6.
- J. Maintain minimum clearance of **6 inches** between tendons and openings.
- K. Prior to concrete placement, mark tendon locations on formwork with spray paint.
- L. Do not install sleeves within **36 inches** of anchorages after tendon layout has been inspected unless authorized in writing by Architect.
- M. Do not install conduit, pipe, or embeds requiring movement of tendons after tendon layout has been inspected unless authorized in writing by Architect.
- N. Do not use couplers unless location has been approved by Architect.

3.4 SHEATHING INSPECTION AND REPAIR

- A. Inspect sheathing for damage after installing tendons. Repair damaged areas by restoring post-tensioning coating and repairing or replacing tendon sheathing.
 - 1. Ensure that sheathing is watertight and there are no air voids.
 - 2. Follow tape repair procedures in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Maximum length of exposed strand behind anchorages is as follows:
 - 1. Fixed End: **12 inches**.
 - 2. Intermediate and Stressing End: **1 inch**.
- C. Immediately remove and replace tendons that have damaged strand.

3.5 CONCRETE PLACEMENT

- A. Place concrete as specified in Division 03 Section "Cast-in-Place Concrete." Ensure compaction of concrete around anchorages.
- B. Ensure that position of tendon and non-prestressed steel reinforcement does not change during concrete placement. Reposition tendons and non-prestressed steel reinforcement moved during concrete placement.
- C. Ensure that method of concrete placement does not damage tendon sheathing. Do not support pump lines, chutes, or other concrete placing equipment on tendons.

3.6 TENDON STRESSING

- A. Calibrate stressing jacks and gages at start of job and at least every six months thereafter. Keep copies of calibration certificates for each jack-and-gage pair on Project site and available for inspection. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.
- B. Stress tendons only under supervision of qualified post-tensioning superintendent.
- C. Do not begin stressing operations until concrete strength has reached 2500 psi as indicated by compression tests of field-cured cylinders.
- D. Complete stressing within 96 hours of concrete placement.
- E. If concrete has not reached required strength, obtain Architect's approval to partially stress tendons and delay final stressing until concrete has reached required strength.
- F. If detensioning and restressing of tendon is required, discard wedges used in original stressing and provide new wedges.
- G. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest **1/8 inch**.
- H. Submit stressing records within one day of completion of stressing. If discrepancies between measured and calculated elongations exceed plus or minus 7 percent, resolve these discrepancies to satisfaction of Architect/Structural Engineer.
- I. Prestressing will be considered acceptable if gage pressures shown on stressing record correspond to required stressing force and calculated and measured elongations agree within 7 percent.
- J. If measured elongations deviate from calculated elongations by more than 7 percent, additional testing, restressing, strengthening, or replacement of affected elements may be required.
- K. Stressing Records: Testing agency shall record the following information during stressing operations:
 - 1. Name of Project.
 - 2. Date of approved installation drawings used for installation and stressing.
 - 3. Floor number and concrete placement area.

4. Date of stressing operation.
5. Weather conditions including temperature and rainfall.
6. Name and signature of inspector.
7. Name of individual in charge of stressing operation.
8. Serial or identification numbers of jack and gage.
9. Date of jack-and-gage calibration certificates.
10. Gage pressure to achieve required stressing force per supplied calibration chart.
11. Tendon identification mark.
12. Calculated tendon elongation.
13. Actual tendon elongation.

3.7 TENDON FINISHING

- A. Do not cut strand tails or cover anchorages until stressing records have been reviewed and approved by Architect.
- B. Cut strand tails as soon as possible after approval of elongations according to ACI 423.6.
- C. Patch stressing pockets within one day of cutting strand tail. Clean inside surface of pocket to remove laitance or post-tensioning coating before installing patch material. Finish patch material flush with adjacent concrete.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties.
 1. Before concrete placement, testing agency will inspect the following for compliance with post-tensioning installation drawings and the Contract Documents:
 - a. Location and number of tendons.
 - b. Tendon profiles and cover.
 - c. Installation of backup bars, hairpins, and other non-prestressed reinforcement shown on post-tensioning installation drawings.
 - d. Installation of pocket formers and anchorage devices.
 - e. Repair of damaged sheathing.
 2. Testing agency will record tendon elongations during stressing.
 3. Testing agency will immediately report deviations from the Contract Documents to Architect.
- B. Prepare test and inspection reports.

3.9 PROTECTION

- A. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade component.
- B. Prevent water from entering tendons during installation and stressing.

- C. Provide weather protection to stressing-end anchorages if strand tails are not cut within 10 days of stressing the tendons.

3.10 REPAIRS

- A. Submit repair procedure to Architect for evaluation and approval.
- B. Do not proceed with repairs requiring removal of concrete unless authorized in writing by Architect.

END OF SECTION 033816

SECTION 034400 – AUTOCLAVED AERATED CONCRETE PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Precast Autoclaved Aerated Concrete (AAC) Panels.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's standard product literature, specifications, and other similar information describing materials and system to be used, including installation instructions for each type of product indicated.
- B. Fire Resistance Test Data: Submit UL Fire Resistance assembly or other qualified testing agency test data for the floor/ceiling assembly which is acceptable to the Authority Having Jurisdiction.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is authorized by the manufacturer for application of AAC products required for this Project.
- B. Product Standards: ASTM C 1386.
- C. Fire-Resistance Ratings: Where indicated, provide AAC panel systems 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.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing and shipping:
 - 1. Transport and handle AAC panels with equipment designed to protect panels from strain, warping, cracking, chipping, or staining.
 - 2. Placing AAC panels in direct contact with earth is prohibited.

B. Storage and protection:

1. Store to protect from strain, warping, cracking, chipping, or staining.
2. Store in same position as transported.
3. Store on firm, level, smooth surface.
4. Place so identification marks are discernible.

C. Damaged or deteriorated materials shall be removed from the site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for temperature and other conditions affecting installation.

1.7 COORDINATION

- A. Coordinate installation with requirements of the assembly construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General System Requirements: Provide all AAC panels by a single manufacturer for a unified installation.
- B. Manufacturer: Provide AAC panels, thickness and size, by the manufacturer indicated per the UL Design Assembly as referenced on the Drawings.

2.2 ACCESSORIES

- A. Attachment Clips: Aluminum angles as required per the UL Design Assembly as referenced on the Drawings.
- B. Mortar: Thin-bed mortar, acceptable to the panel manufacturer, installed as required per the UL Design Assembly as referenced on the Drawings.
- C. Intumescent Strip: Self-adhesive intumescent strips, as an alternate to mortar where allowed per the UL Design Assembly as referenced on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine wall assemblies, with Installer present, for conditions affecting performance.
1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. General: Install AAC panels according to manufacturer's written instructions and as required per the UL Design Assembly referenced on the Drawings.

3.3 PATCHING AND CLEANING

- A. Patch spall and chips in AAC panels in accordance with AAC panel manufacturer's recommendations.
- B. Cleaning: Thoroughly clean work area and job site, properly dispose of all debris and refuse and leave area ready for work of other trades.

END OF SECTION 034400

SECTION 035413 – GYPSUM CEMENT UNDERLAYMENT

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. Gypsum-cement-based, self-leveling underlayment for interior installations over wood type floor sheathing materials.
 - 2. [Impact sound control underlayment, where required.](#)

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's standard product literature, specifications, and other similar information describing materials and system to be used, including installation instructions for each type of product indicated.
- B. Fire Resistance Test Data: Submit UL Fire Resistance assembly or other qualified testing agency test data for the floor/ceiling assembly which is acceptable to the Authority Having Jurisdiction.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is authorized by the manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.
- C. Fire-Resistance Ratings: Where indicated, provide gypsum-cement underlayment systems 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.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project in their original, unopened packages. Protect from weather and store in a manner that will prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Damaged or deteriorated materials shall be removed from the site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place gypsum-cement-based underlayment only when ambient temperature and temperature of substrates are between **50 and 80 deg F**.

1.7 COORDINATION

- A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 General System Requirements: Provide all underlayment materials by a single manufacturer for a unified installation.

- A. Sound Control: The floor/ceiling assembly of upper level floors, including finished flooring materials as specified and provided by others, to have not less than the following ratings as required by the Building Code or as indicated on the Drawings:
 - 1. **IIC rating: Not less than 50, or a FIIC rating of 45 (field tested rating).**
 - 2. **STC rating: Not less than 50, or a FSTC rating of 45 (field tested rating).**
- B. See the Drawings for proposed sound control method for the floor/ceiling assembly.
- C. Where sound control underlayment is required, it may be installed under or above the gypsum-cement underlayment, coordinate with flooring contractor.

2.2 GYPSUM-CEMENT-BASED UNDERLAYMENTS

- A. Underlayment: Gypsum-cement-based, self-leveling product that can be applied in a uniform thickness as required by the specified UL Design as indicated on the Drawings where applicable.
- B. Provide all other preparation materials, primers, and sealers, when required, and as recommended by underlayment manufacturer.
- C. Provide all mix ingredients to comply with manufacturer's written instructions.
- D. Compressive Strength: Not less than **2200 psi** at 28 days when tested according to ASTM C 109/C 109M.

- E. Density: 110 pounds per cubic foot.
- F. Sump: Underlayment mix shall be tested for a slump using a 2" (i.d.) x 4" cylinder resulting in a patty size of 8 1/2" plus or minus 1 inch diameter.

2.3 IMPACT SOUND CONTROL UNDERLAYMENT – (where required)

- A. General: The following specification for impact sound control underlayment installed under gypsum cement underlayment for upper level floors, if not otherwise provided by the finish flooring manufacturer, shall comply with the specified fire rated floor/ceiling assembly. Coordinate with location of the finish flooring products.
 - 1. Product shall be by the same manufacturer as the gypsum cement underlayment to provide a manufacturer's system warranty.
 - 2. Install per manufacturer's recommendations.
 - 3. Coordinate locations with floor covering installation requirements.
- B. Impact Sound Control Rating: Provide and install impact sound control underlayment system as required by the manufacturer to meet or exceed minimum Building Code requirements as indicated.
- C. Provide all materials required for a complete installation, including but not limited to perimeter isolation strips and tape, as required by the manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance.
 - 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Condition and Cleaning of Subfloor: Subfloor shall be structurally sound, broom clean, dry and free of mud, oil, grease, and other contaminating factors before product is installed.
- B. Examine the subfloor: Examine for proper nailing and replace all material weakened or delaminated during construction.
- C. Leak Prevention: Fill cracks and voids with a quick setting patching or caulking material where leakage of product could occur.
- D. Priming Subfloor: Prime the subfloor, when required, and as recommended by underlayment manufacturer using the manufacturer's recommended primer.
- E. Prepare subfloor: Prepare surfaces in strict compliance with the underlayment manufacturer's written instructions.

3.3 APPLICATION

- A. General: Install underlayment components according to manufacturer's written instructions.
- B. Sound Control Mat, (where required): Install sound control materials according to manufacturer's written instructions.
 - 1. Do not install mechanical fasteners that penetrate through the sound control materials.
- C. Gypsum Cement Underlayment: Mix and apply underlayment to produce uniform, level surface.
- D. Unless indicated or required and approved otherwise, provide a minimum **3/4 inch** thickness of gypsum concrete underlayment poured over the sound control mat and subfloor as indicated on drawings.
- E. Spread and screed underlayment to a smooth surface.
- F. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- G. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- H. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PREPARATION FOR FLOOR COVERINGS

- A. Sealing: Seal all areas that receive glue down floor covering with the underlayment manufacturer's recommended sealer and according to the product manufacturer's specifications. Any floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering to be used.
 - 1. Where floor covering product manufacturers require special adhesive or installation systems, their requirements supersede the underlayment manufacturer's recommendations.

3.5 PROTECTION AND CLEANING

- A. Protection from Heavy Loads: During construction, place temporary wood planking over the gypsum concrete underlayment where subject to heavy wheeled or concentrated loads.
- B. Cleaning: Thoroughly clean work area and job site, properly dispose of all debris and refuse and leave area ready for work of other trades or Owner occupancy.

END OF SECTION 035413

SECTION 042000 - 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. Miscellaneous masonry accessories.

1.3 SUBMITTALS

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

1.4 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. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602, unless modified by requirements in the Contract Documents.

1.5 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. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 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. 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.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 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.

2.2 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 units for outside corners, unless otherwise indicated.

- B. Concrete Masonry Units: ASTM C 90.
 - 1. Weight Classification: Normal weight.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 3. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 CONCRETE AND MASONRY LINTELS

- A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
- B. Concrete Lintels: Precast units made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by same method used for concrete masonry units.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 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.
- E. Mortar Cement: ASTM C 1329.
- 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.
- G. Aggregate for Grout: ASTM C 404.
- H. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, 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: W1.7 or 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
 - 5. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 7. Provide in lengths of not less than 10 feet.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
 - b. Strips, not less than 3/4 inch thick and 10 inches wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - c. Sheets or strips full depth of cavity and installed to full height of cavity.
 - d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.

2.7 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.

2.8 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 and lime.

- B. 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 or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S.
 3. For mortar parge coats, use Type S or N.
 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- C. 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.

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. Verify that foundations are within tolerances specified.
 2. 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 cavity and composite walls and other masonry construction to full thickness shown. 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. 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 space between steel frames and masonry solidly with mortar, unless otherwise indicated.

- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

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

3.5 MASONRY JOINT REINFORCEMENT

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

3.6 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.7 LINTELS

- A. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- C. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

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.

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.

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 non-masonry 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 masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

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.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1- GENERAL

1.01 WORK INCLUDES:

Structural steel framing members, structural steel trusses, structural steel support members, baseplates, suspension cables, sag rods, struts, and other required bracing, welds and fasteners.

1.02 QUALITY ASSURANCE:

A. Codes and Standards

1. ASTM 992 - Structural Steel.
2. ASTM A53 - Hot-Dipped, Zinc Coated Welded and Seamless Steel Pipe.
3. ASTM A325 - High Strength Bolts for Structural Steel Joints.
4. AWS D1.1 - Structural Welding Code.
5. AISC - Specification for the Design Fabrication, and Erection of Structural Steel for Buildings.
6. FS TT-P-31 - Paint, Oil: Iron Oxide, Ready Mix, Red and Brown.
7. AISC - Code of Standard Practice for Steel Buildings and Bridges - Section 4.2.1 shall be specifically excluded.
8. ASTM A124 - Zinc (hot dip galvanized) coating on iron and steel products.

1.03 SUBMITTALS:

A. Submit under provisions of the General Conditions of the Contract for construction.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments and fasteners.
2. All connections.
3. Cambers.
4. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
5. Submit connection calculations for review. See 1.05 (D).

C. Manufacturer's Mill Certificate: Certifying that rolled sections, high strength bolts and headed shear studs meet or exceed specified requirements.

D. Welders' Certificates: Certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.

1.04 QUALITY ASSURANCE:

- A. Fabricate structural steel members in accordance with AISC-Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. Specifically excluded is Section 4.2.1 of the AISC "Code of Standard Practice".
- B. The fabricator shall assume all responsibility for the suitability and adequacy of the design of all connections not specifically detailed on the structural drawings and to meet the AASHTO Guide Specifications for Fracture Critical Design and Florida DOT Standard Specifications.
- C. Maintain one copy of document on site.
- D. Design connections, not detailed on the drawings, under the direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Florida. Connection calculations and shop drawings shall be signed and bear his seal. Connection design shall be in accordance with the 9th Edition of the AISC Manual of Steel Construction.
- E. Bolts shall be designed as bearing type.

1.05 QUALIFICATIONS:

- A. Fabricator: Company specializing in performing the work of this Section with minimum five years experience and a Class 2 rating, must be approved by the Structural Engineer.
- B. Erector: Company specializing in performing the work of this Section with minimum five years experience and class 2 rating, must be approved by the Structural Engineer.

1.06 DELIVERY AND STORAGE:

- A. Deliver structural steel and fabricated items to job site with shop coat paint already applied.
- B. Store off ground and protect from weather in a manner satisfactory to Architect/Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel
 - 1. All structural steel tube sections shall be ASTM A500, Grade B ($F_y = 46$ ksi).
 - 2. All structural steel pipe sections shall be ASTM A501.
 - 3. All structural steel wide flanges shall be ASTM A992.
- B. Anchor Bolts

1. All anchor bolts shall be ASTM A307 unless otherwise noted on the drawings, or specified herein.

C. Connection Bolts

1. All field bolts shall be high strength steel bolts for structural joints and shall conform to ASTM A325, Type 1 or 2, unless otherwise noted on the drawings. Connections shall be bearing type.

D. Direct Tension Indicators

1. ASTM F959. All bolted connections shall be made with direct tension indicating washers. Hardened steel washers shall be provided as required for proper installation.

E. Finish

1. Rust inhibitive primer Rustoleum 769, Southern Coatings R.I.P. 476, Pittsburgh Iron Hide or approved equal.
2. Galvanize structural steel members embedded in or supporting exterior masonry and other steel members where noted in the drawings. Provide 1.25 ounces per square foot per ASTM A123. Galvanizing is not required for structural steel embedded in concrete.
3. See 3.08-A for additional information.

F. Grout

1. All grout shall be Master Flo 713 by Master Builders, Cleveland, Ohio, NS-NS Grout by Euclid Chemical or SonogROUT by Sonneborn Building Products, Inc.

PART 3 - EXECUTION

3.01 ANCHOR BOLTS:

- A. Furnish anchor bolts and setting plans in ample time to prevent delay of other work.
- B. Before proceeding with the erection and in time to permit correction of defective setting, the Contractor shall verify the location and elevation of all anchor bolts for column bases. He shall report immediately to the Architect/Engineer, in writing, any discrepancies found; otherwise the Contractor shall pay the entire cost of removing and resetting of any anchor bolts later found to be incorrectly placed, and/or the cost of any necessary changes in steel work required by reason of the incorrectly placed bolts.
- C. Contractor shall verify and/or other dimensions and take such measurements as are required for the proper construction of the work.

3.02 FABRICATION:

- A. Substitutions of section or modifications of details shall be made only when approved by the Architect/Engineer and any additional cost is to be borne by Contractor.
- B. Mill contact surfaces of column splices (and other components shown on the drawings) to meet requirements of ASTM A6, Table 24.
- C. Near one end of piece indicate position of distinguishing mark in a manner that agrees with shop drawings indications.

3.03 CONNECTIONS:

- A. All welding shall be indicated by using A.W.S. symbols showing length, size and spacing (if not continuous). Auxiliary views shall be shown to clarify all welding.
- B. Shop connections: Shall be bearing high strength bolted or welded, unless noted otherwise.
- C. High Strength Bolts: Shall be 3/4 inches diameter, unless noted otherwise.
- D. Connections shall be Framed Beam Constructions that conform to Table 1 of the AISC Manual of Steel Construction unless otherwise noted.
- E. The length of connections shall be the T distance of the beam web, unless otherwise noted.
- F. All field connections shall be bolted unless otherwise shown.
- G. Connections for beams shall be selected by fabricator to support the reaction listed on the drawings. If the reaction is not listed design connection to support half the total uniform load capacity tabulated in the AISC (9th Edition) tables for allowable loads on beams for the given shape, span and steel specification of the beam in question, unless otherwise shown or noted on the drawings. The effect of concentrated loads shall also be considered and an analysis of loading and end reactions made if necessary if the end reaction of beam is not shown on drawings.

3.04 WELDING:

- A. All work herein relating to welds, welding, and oxygen cutting shall be executed in accordance with the standard definitions of welding terms and master chart of welding processes of the American Welding Society, as amended to date.
- B. Welding shall be performed by welders, welding operators and tackers who have previously qualified by tests in accordance with the requirements of the American Welding Society Code (AWS D1.1-75 including 1976 and 1977 revisions) for the type and process of welding required.
- C. All welders working on the project shall be assigned an identifying symbol or mark. Each welder will be required to mark or stamp his symbol on each weldment completed, for identification. A report shall be maintained of welders

employed, date of qualification and symbol or identification mark assigned to each.

- D. Contractor shall submit to the Architect/Engineer one copy of welding certificates for all personnel to be employed on the project to do welding.
- E. All items of equipment for welding and oxygen cutting shall be so designed and manufactured and be in such condition as to enable qualified welders and welding operators to follow the procedures and attain the results prescribed in the Code for Welding in Building Construction D1.0-69, of the American Welding Society.
- F. Welding shall not be done when the ambient temperature is lower than 0 degrees Fahrenheit, when surfaces are wet or exposed to rain, snow or high wind nor when welders are exposed to inclement conditions.
- G. The sized and lengths of welds shall not be less than those specified by design requirements and detailed drawings, nor shall they be substantially in excess of those requirements without approval. The location of welds shall not be changed without approval.
- H. Surfaces to be welded shall be smooth, uniform and free from fins, tears or other defects which would adversely affect the quality or strength of the weld. Surfaces to be welded shall also be free from loose or thick scale, slag, rust, grease or other foreign material that will prevent proper welding or produce objectionable fumes. Mill scale that withstands vigorous wire brushing or a light film of drying oil, or a thin rust inhibitive coating may remain.
- I. In assembling and joining parts of a structure or of built-up members and in welding reinforcing parts to members, the procedure and sequence shall be such as will minimize distortion and shrinkage. The Contractor will be held responsible for any shrinkage or distortion in the welds or parent material, and will be required to remedy or replace any defective work.
- J. No welding shall begin until joint elements are bolted in intimate contact or adjusted to dimensions shown on the drawings, or both, with allowance for any weld shrinkage that is expected.
- K. No members are to be spliced without prior written approval of the Architect/Engineer.
- L. All groove welds shall have complete penetration unless otherwise specified on the drawings.
- M. Remove backing strips from all welds flush with the base metal. Remove at least the last 18 inch by machining or grinding.
- N. Butt welds on exterior exposed surfaces and where indicated on the drawings shall be ground flush.
- O. The Architect/Engineer may employ an approved independent testing laboratory for testing and inspection of shop and field welds and inspection of field welding procedures.

3.05 BOLTS:

- A. All bolted connections shall be made with high-strength bearing-type bolts.
- B. The Contractor shall submit in writing to the Architect/Engineer, the proposed method of installing high-strength bolts and "Load Indicator" washers and this method must be approved in writing by the Architect/Engineer before the work commences.
- C. All holes shall be accurately spaced to allow the insertion of high-strength bolts. Hole diameter shall not be more than 1/16 inch larger than bolt diameter.
- D. All contact surfaces of high-strength bolted field joints shall be cleaned but unpainted
- E. High-strength bolted joints are to be made without the use of erection bolts - some of the high-strength bolts themselves serving that purpose.
- F. Before bolts are tightened, the parts to be bolted shall be brought tightly together by sufficient high-strength bolts used as fitting-up bolts. These bolts shall be retightened as all the bolts are finally tightened.
- G. Bolts shall be tightened by an air driven impact wrench of a capacity sufficient to break the bolt. Bolt tension shall be reached when a maximum gap of 0.015 inch exists under the load indicator washer.
- H. Each bolting crew shall distinctly mark the joints as they are final bolted so that the inspector can check and test the joint and refer back to the crew responsible for the joint.

3.06 PAINTING:

- A. All structural steel to receive an abrasive blast to a white metal finish in accordance with SSPC-SP10 to obtain a blast profile prior to applying the Carbo Zinc II HS coating. Strict compliance to manufacturers recommendations must be achieved.
- B. Apply two coats shop paint to surfaces not to be encased in concrete.
 - 1. Clean by hand or power tool all rust, scale, weld slag, dirt, and other foreign matter. Oil and grease removed with solvents.
 - 2. Primer - Two coats.
- C. Steel to be encased in concrete shall not be painted. Clean as per Part A.
- D. Do not paint within 2" of field welds, contact surfaces of friction bolted connections, or surfaces to receive fusion weld studs.
- E. After erection apply one coat of paint to all steel areas which are scraped, abraded, over field welds, bolts and all other unpainted areas not to receive

future welding.

- F. All steel surfaces to receive spray applied fireproofing shall be free of oil grease, paint or primers, loose mill scale, dirt or other foreign substances. Where necessary cleaning of surfaces to receive fireproofing shall be the responsibility of the General Contractor.

3.07 ERECTION:

- A. The Contractor shall completely outline a proposed method and sequence of erection to the Architect/Engineer for approval before delivering any material to the job site. The outline shall be prepared to avoid delay or damage to the work of other contractors.
- B. Temporary bracing and guy lines shall be provided to adequately protect all persons and property and to ensure proper alignment.
- C. Set column base true and level by means of double nuts. Grout under bearing plates with Embeco Grout, or equal.
- D. The Contractor alone shall be responsible for the correct fitting of all structural members and for the elevation and alignment of the finished structure.
- E. No bolting or welding shall be done until as much of the structure as will be stiffened by the welding or bolting has been properly aligned.
- F. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged to admit bolts shall be reamed.
- G. Burning and drifting may be used to align unfair holes in secondary bracing members only upon approval of the Architect/Engineer.
- H. Upon completion of erection and before final acceptance, the Contractor shall remove all falsework, rubbish and temporary buildings used by him.
- I. Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Material stored at the job site shall be so placed that no members shall be damaged and shall be protected against corrosion or deterioration of any kind.
- J. Dissimilar Materials: Where aluminum surfaces come in contact with metals other than stainless steel, keep aluminum surfaced from direct contact with such parts by:
 - 1. Painting dissimilar metals with prime coats of aluminum metal and masonry paint excluding those containing lead pigmentation.
 - 2. Painting any dissimilar metal with a coating of heavy bodied bituminous paint.
 - 3. A non-absorptive tape or gasket.

3.8 INSPECTION:

- A. Access to places where materials for this Contract are being fabricated or produced shall be provided to the Architect/Engineer for the purpose if inspection.
- B. The Architect/Engineer reserves the right to reject any material, at any time before final acceptance, which does not conform to all of the requirements of the drawings and specification.
- C. High Strength Bolted Connections
 - 1. The Inspector shall be notified at least 24 hours in advance of the beginning of high strength bolting operations.
 - 2. At the beginning of high strength bolting the Inspector shall observe the Contractors method of installation.
 - 3. The Inspector shall observe at random 10% of all bolted connections in accordance with ASTM F959, Table 2. If this inspection uncovers bolted connections having load indicator washer gaps greater than specified, the Contractor shall retighten or replace those bolts not conforming and check all remaining connections. Each connection checked shall be marked in a clearly visible manner. After the Contractor has checked all connections, the Inspector shall check an additional 10%.
- D. Welded Connections
 - 1. Production Welding
 - a. Once production welding has begun, any changes made to the welding set-up as determined in paragraph D1. shall require that the testing in paragraphs D.1.C. and D.1.d. be performed prior to resuming production welding.
 - b. In production, studs on which a full 360 degrees flash is not obtained may, at the option of the contractor, be repaired by adding a 5/16th fillet weld in place of the missing flash. The repair weld shall extend at least 3.8 inch beyond each end of the discontinuity being repaired.
 - c. The pre-production test required, if successful, shall also serve to qualify the stud welding operator.
 - d. Before any production studs are welded by an operator not involved in the pre-production set-up, the operator shall have the first two studs welded by him tested in accordance with the provisions of D.1.c. and D.1.d. When the two welded studs have been tested and found satisfactory, the operator may then weld production studs.

END OF SECTION 05120

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous steel framing and supports.
 - 2. Metal bollards.
 - 3. Aluminum T-Bar

1.3 SUBMITTALS

- A. Product Data: Submit product data and details for aluminum T-Bar included with details for flashing and waterproofing of exterior balconies, stairs, and breezeways.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- C. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
- F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

2.3 NONFERROUS METALS

A. Aluminum Extrusions: **ASTM B 221**, Alloy 6063-T6.

1. Aluminum T-Bar to be Alloy 6063-T5.
 - a. Finish: Field prime and paint per Division 09, Painting.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or **ASTM F 1941**, Class Fe/Zn 5, at exterior walls.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or **ASTM F 1941**, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group **1** stainless-steel bolts, **ASTM F 593**, and nuts, **ASTM F 594**.

2.5 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Division 09 painting Sections.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. 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.

E. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of **3,000 psi**.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than **24 inches** o.c.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe 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.

2.8 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 galvanized steel pipe **1/4-inch** wall-thickness rectangular steel tubing.
- B. Fabricate sleeves for bollard anchorage from steel pipe or tubing with **1/4-inch-** thick steel plate welded to bottom of sleeve.
- C. Paint galvanized bollards, color as selected by Owner.

2.9 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.
- B. Galvanize loose steel lintels located in exterior walls.

- C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.11 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.
- 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.
- C. Shop Priming: Apply shop primer to 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 metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING METAL BOLLARDS

- A. Fill metal bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout.
- C. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- D. Fill bollards solidly with concrete and install Schedule 40 PVC caps on bollards.

3.3 INSTALLING ALUMINUM T-BAR

- A. Installation of the aluminum T-bar for exterior balconies, stairs, and breezeways shall be as indicated on the drawings or as required by the waterproofing system manufacturer.
- B. Install as a continuous piece without joints where possible.
- C. Field paint per Section 099100-Painting.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION 055000

SECTION 055110 - METAL STAIR AND RELATED COMPONENT ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Prefabricated steel stair assembly components.
 - 2. Precast concrete stair treads.
 - 3. Installations complete of metal stair and related component assemblies.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide indicated stair installations capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs.
 - 1. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 lb./sq. ft. or a concentrated load of 300 lb. on an area of 4 sq. in., whichever produces the greater stress.
 - 2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.
 - 3. Limit deflection of treads, platforms, and framing members to $L/360$ or 1/4 inch, whichever is less.

1.04 SUBMITTALS

- A. Product Data: For stairs and the following:
 - 1. Prefabricated steel stringers and steel stair assembly components.
 - 2. Precast concrete treads.
 - 3. Fasteners, shims, and paint products.
- B. Shop Drawings & Calculations: Show fabrication and installation details for metal stairs. Include plans, elevations, sections and details of metal stairs, their connections, and calculations. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
 - 1. Submit complete shop drawings and calculations prepared by, or under the supervision of, and signed and sealed by, a registered Professional Engineer, licensed in the State of the authority having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Arrange for all stair assemblies specified in this Section to be fabricated and installed by the same firm.
- B. Professional Engineer Qualifications: A professional engineer who is legally registered in the State of the authority having jurisdiction and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal stairs (including treads) that are similar to those indicated for this Project in material, design, and extent.
- C. Fabricator Qualifications: A firm experienced in producing metal stair assemblies, including precast concrete treads and related components, similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual construction conditions by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION

- A. Coordinate installation of anchorages for metal stairs, treads, 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.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers / Fabricators: Qualified local or other companies / fabricators acceptable to Architect / Owner, with capabilities to comply with indicated design and specified requirements.

2.02 FERROUS METALS

- A. Metal Surfaces: Provide metal free from pitting, seam marks, roller marks, and other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Uncoated, Hot-Rolled Steel Sheet: Commercial quality, complying with ASTM A 569/A 569M; or structural quality, complying with ASTM A 570/A 570M, Grade 30, unless another grade is required by design loads.
- D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.03 PRECAST CONCRETE TREADS

- A. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi and a total air content of not less than 4 percent or more than 6 percent.
- B. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch-diameter wire; comply with ASTM A 185 and ASTM A 82, except for minimum wire size.

2.04 FASTENERS

- A. Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.05 SHIMS

- A. Provide multi-polymer plastic formulated, or similar material, bearing shim strips, 1/4 inch thick, between steel stair stringer and concrete surface as indicated on Drawings.

2.06 PAINT

- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."
- B. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers or cold-applied asphalt emulsion complying with ASTM D 1187.

2.07 FABRICATION

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, precast concrete treads, metal risers, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join steel components by welding, unless otherwise indicated. Join other materials as detailed or as otherwise required by applicable industry standards.
 - 2. Use connections that maintain structural value of joined pieces.
- 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. Commercial class, unless otherwise indicated.
- C. Shop Assembly: Preassemble stairs 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.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Shear and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.
- 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. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Install precast concrete treads to comply with design and configuration indicated and to conform to accepted shop drawings and other Submittals.

2.08 STEEL-FRAMED STAIR COMPONENTS

- A. Stair Framing and Related Component Construction: Fabricate stringers of structural-steel channels, plates, or a combination of both, as indicated. Provide closures for exposed ends of stringers. Construct sub-platforms and platforms of indicated component materials. Bolt or weld headers to stringers; bolt or weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
- B. Metal Risers, Sub-treads, and Sub-platforms: Form to configurations shown from required steel plate or sheet as necessary to support indicated loads.
1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated. Attach risers, treads or sub-treads to stringers with brackets made of steel angles or bars. Weld brackets to stringers.
- C. Provide steel nosing for stair landing edge conditions as indicated on Drawings.

2.09 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. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed products:
1. Interiors (SSPC Zone 1A): SSPC SP 3, "Power Tool Cleaning."
- D. Apply shop primer to prepared surfaces of metal stair components, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.01 INSTALLATION

- 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. Install fabricated components so that finished surfaces of treads and landings at exterior stairs have positive drainage to shed water off their surfaces and away from locations where treads and landings that abut walls or other surfaces might cause ponding water conditions.
- C. 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 from rack.
- D. Corrosion Protection: Coat concealed surfaces of metal that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with neoprene gasket or a heavy coat of bituminous paint.
- E. Install shims between stair stringers and concrete surfaces.
- F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- G. 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.
- H. 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.
- I. Place and finish concrete fill for treads and platforms to comply with Cast-in-Place Concrete specification requirements or notes on Drawings.
- J. Install steel nosing over the aluminum T-bar for stair landing edge conditions as indicated on drawings.
 - 1. Provide separation for dissimilar metals to prevent galvanic corrosion.

3.02 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 9 Section "Painting."

END OF SECTION 055110

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Aluminum pipe and tube railings and handrails.

1.03 PERFORMANCE REQUIREMENTS

- A. When engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
- B. Structural Performance: 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 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. 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. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Manufacturer's data of product lines of specified type(s) of railings.
 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings & Calculations: Include plans, elevations, sections, details, attachments to other work, and calculations.
1. For installed products indicated to comply with design loads, submit complete shop drawings and calculations prepared by, or under the supervision of, and signed and sealed by, a Professional Engineer registered in the State of the authority having jurisdiction.

1.05 QUALITY ASSURANCE

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

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings 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 railings 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.

1.07 COORDINATION AND SCHEDULING

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

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements and as indicated on the Drawings, provide products by manufacturers that may be incorporated in the Work.
 - 1. Aluminum Pipe and Tube Railings.

2.02 METAL CHARACTERISTICS AND OTHER ITEMS

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.03 ALUMINUM

- A. Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.
- C. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
- D. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.
- E. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.
- F. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

2.04 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Aluminum or Type 304 or 316 stainless-steel fasteners.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

- C. Expansion Anchors: Unless indicated otherwise, provide cast-in-place, chemical or torque-controlled expansion anchors, 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.
- D. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

2.05 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: When required by specified finish, provide primers that comply with Division 09 painting Sections.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. 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.
- E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and elsewhere when indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.
- F. Surface Mounted Post Shims: Provide multi-polymer plastic, or other similar material, bearing shim strips, **1/8 inch thick**, between the bottom of surface mounted metal railing post and concrete surfaces where post are indicated on Drawings to be surface mounted to concrete.

2.06 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections, unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- J. Form changes in direction as follows:
 - 1. As detailed.
 - 2. By bending or by inserting prefabricated elbow fittings.
 - 3. By flush bends or by inserting prefabricated flush-elbow fittings.
 - 4. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
 - 5. By inserting prefabricated flush-elbow fittings of radius indicated.
- K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.07 FINISHES, GENERAL

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

2.08 ALUMINUM FINISHES

- 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. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
 - 1. Color: To be selected by Owner.
- E. Bituminous Paint (where needed to isolate materials to prevent corrosion): Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install railing system based on Drawings and per manufacturer's requirements to comply with all applicable codes.
- B. Fit exposed connections together to form tight, hairline joints.
- C. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- D. Corrosion Protection: Coat concealed surfaces of metal that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with neoprene gasket or a heavy coat of bituminous paint.
- E. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- F. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
 - 1. Install sealant as required to prevent water intrusion.

3.03 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 railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.04 ANCHORING POSTS

- A. Install railing post as indicated on Drawings and per manufacturer's requirements to comply with all applicable codes.
- B. Surface mounted post to have shim installed between post and concrete surfaces.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material or attached to post with set screws.

3.05 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete, masonry, and wood with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using nonwelded connections.

3.06 ATTACHING HANDRAILS TO WALLS

- A. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3.07 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. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.08 PROTECTION

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

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

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. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
 - 3. Wood blocking and nailers.
 - 4. Wood furring and grounds.
 - 5. Wood sleepers.
 - 6. Utility shelving.
 - 7. Plywood backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. 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.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

- B. Kiln-dry lumber after treatment (KDAT) to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, 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 and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than **18 inches** above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 grade.
 - 1. Application: Interior partitions not indicated as load-bearing.
 - 2. Species: Any of the following or as indicated on the Drawings.
 - a. Mixed southern pine; SPIB.
 - b. Hem-fir; WCLIB, or WWPA.
 - c. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- B. Load-Bearing Walls and Partitions: No. 2 grade.
 - 1. Application: Exterior walls and interior load-bearing partitions.
 - 2. Species: As indicated on the Drawings.
 - 3. Modulus of elasticity: As indicated on the Drawings.
- C. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.
 - 1. Species: As indicated on the Drawings.
 - 2. Modulus of elasticity: As indicated on the Drawings.

- D. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - 1. Application: Exposed exterior and interior framing.
 - 2. Species and Grade: As indicated above for load-bearing construction of same type or as indicated on Drawings.

2.5 ENGINEERED WOOD PRODUCTS

- A. Engineered Wood Products, General: Products shall contain no urea formaldehyde.
- B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers that may be incorporated into the Work.
 - 2. Extreme Fiber Stress in Bending, Edgewise: 2,600 psi for 9¼ to 20-inch nominal- depth members.
 - 3. Modulus of Elasticity, Edgewise: 1,900,000 psi.
- D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers that may be incorporated into the Work.
 - 2. Extreme Fiber Stress in Bending, Edgewise: 2,900 psi for 9¼ to 18-inch nominal- depth members.
 - 3. Modulus of Elasticity, Edgewise: 2,000,000 psi.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Furring.
 - 4. Grounds.
 - 5. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

1. Mixed southern pine; SPIB.
 2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. For utility shelving, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine; No. 2 grade; SPIB.
 2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine; No. 2 grade; SPIB.
 2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than **3/4-inch** nominal thickness.

2.8 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, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: **ASME B18.2.1**.
- F. Bolts: Steel bolts complying with **ASTM A 307, Grade A**; with **ASTM A 563** hex nuts and, where indicated, flat washers.

- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies 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 and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.9 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers that may be incorporated into the Work.
- B. Product: Subject to compliance with requirements, provide product indicated on Drawings.
- C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, **G60** coating designation.
1. Use for interior locations unless otherwise indicated.
- E. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185** coating designation; and not less than **0.036 inch** thick.
1. Use for wood-preservative-treated lumber and where indicated.
- F. Stainless-Steel Sheet: ASTM A 666, Type 304.
1. Use for exterior locations and where indicated.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell polyethylene foam, **1/4 inch** thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch**.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

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).
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 120 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 120 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.

3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft.** and to solidly fill space below partitions.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 feet** o.c.
- J. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- K. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
 2. "Fastening Schedule," in the State Building Code.
- M. Use steel common nails unless otherwise indicated. 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. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Comply with indicated fastener patterns where applicable.
 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Gypsum Board: Install **1-by-2-inch nominal** size furring vertically at **16 inches** o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of **2-inch nominal** thickness whose widths equal that of studs. Fasten plates to supporting construction unless otherwise indicated.
1. For exterior walls and interior bearing walls, provide **3-by-4 nominal, 2-by-4-inch nominal, or 2-by-6-inch nominal** size wood studs, where indicated on the Drawings, spaced **16 inches** o.c. unless otherwise indicated.
 2. For interior non-bearing partitions and walls, provide **2-by-4-inch nominal or 2-by-6-inch nominal** size wood studs, where indicated on the Drawings, spaced **16 inches** o.c. unless otherwise indicated.
 3. Provide continuous horizontal blocking at mid-height of walls, where indicated on the Drawings, using members of **2-inch nominal** thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions, or as indicated on the Drawings.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs as indicated on the Drawings.

3.5 FLOOR JOIST FRAMING INSTALLATION

- A. General: Install floor joists with crown edge up and support ends of each member with not less than **1 ½ inches** of bearing on wood or metal, or **3 inches** on masonry. Attach floor joists as follows:
1. Where supported on wood members, by using metal framing anchors.
 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Fire Cuts: At joists built into masonry, bevel cut ends **3 inches** and do not embed more than **4 inches**.
- C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds **48 inches**.
- D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than **2 inches** from top or bottom.
- E. Provide solid blocking of **2-inch nominal** thickness by depth of joist at ends of joists unless nailed to header or band.
- F. Lap members framing from opposite sides of beams, girders, or partitions not less than **4 inches** or securely tie opposing members together. Provide solid blocking of **2-inch nominal** thickness by depth of joist over supports.
- G. Anchor members paralleling masonry with **1/4-by-1-1/4-inch** metal strap anchors spaced not more than **96 inches** o.c., extending over and fastening to three joists.

Embed anchors at least **4 inches** into grouted masonry with ends bent at right angles and extending **4 inches** beyond bend.

- H. Provide solid blocking between joists under jamb studs for openings.
- I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 - 1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- J. Provide bridging of type indicated below, at intervals of **96 inches** o.c., between joists.
 - 1. Diagonal wood bridging formed from bevel-cut, **1-by-3-inch nominal**- size lumber, double-crossed and nailed at both ends to joists.
 - 2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide **1-by-8-inch nominal**- size or **2-by-4-inch nominal**- size stringers spaced **48 inches** o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and **2 inches** deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and **2 inches** deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide **1-by-6-inch nominal**- size boards between every third pair of rafters, but not more than **48 inches** o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 TIMBER FRAMING INSTALLATION

- A. Install timber with crown edge up and provide not less than **4 inches** of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.
- B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide **1/2-inch** air space at sides and ends of wood members.
- C. Install wood posts using metal anchors indicated.
- D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

3.8 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 – SHEATHING

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. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Radiant barrier roof sheathing.
 - 4. Subflooring.
 - 5. Draftstopping.
 - 6. Fasteners.
 - 7. Sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies 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 from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual".

2.2 WOOD PANEL PRODUCTS

- A. Plywood: DOC PS 1.
- B. Oriented Strand Board: DOC PS 2.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

2.5 WALL SHEATHING

- A. Plywood Wall Sheathing: Preservative Treated, Exterior, Structural I sheathing.
 - 1. Span Rating: As required to suit stud spacing indicated on Drawings.
 - 2. APA Rated.
 - 3. Nominal Thickness: As indicated on Drawings.

- B. Plywood Wall Sheathing: Exterior, Structural I sheathing.
 - 1. Span Rating: As required to suit stud spacing indicated on Drawings.
 - 2. APA Rated, 4-ply.
 - 3. Nominal Thickness: As indicated on Drawings.
- C. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
 - 1. Span Rating: As required to suit stud spacing indicated on Drawings.
 - 2. APA Rated.
 - 3. Nominal Thickness: As indicated on Drawings.
- D. **Alternate Wall Sheathing:** Oriented-Strand-Board Wall Sheathing; (Combination wall sheathing, water-resistive barrier, and air barrier): With integral water-resistive barrier, Exposure 1 sheathing.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; **ZIP System Wall Sheathing**.
 - 2. Span Rating: As required to suit stud spacing indicated on Drawings.
 - 3. Nominal Thickness: As indicated on Drawings.
 - 4. Edge Profile: Square edge.
 - 5. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches and 24-inches on centers spacings.
 - 6. Performance Standard: DOC PS2-10 and ICC-ES ESR-1474.
 - 7. Factory laminated integral water-resistive barrier facer.
 - 8. Perm Rating of Integral Water-Resistive Barrier: 12-16 perms.
 - 9. Assembly maximum air leakage of 0.0072 cfm/sq. ft. infiltration and 0.0023 cfm/sq. ft. exfiltration at a pressure differential of 1.57.
 - 10. Exposure Time: Designed to resist weather exposure for 180 days.
- E. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
 - 1. Type and Thickness: Fire Rated Type X, 5/8 inch thick, where indicated on Drawings.
 - 2. Edge and End Configuration: Square.
 - 3. Size: 48 by 96 inches or 48 by 108 inches for vertical or horizontal installation or as required for coordination with framing and to comply with the specified fire rated assembly.
- F. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Type and Thickness: Fire Rated Type X, 5/8 inch thick, where indicated on Drawings.
 - 2. Size: 48 by 96 inches or 48 by 108 inches or 48 by 120 inches for vertical or horizontal installation or as required for coordination with framing and to comply with the specified fire rated assembly.

2.6 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.
 - 1. Span Rating: As required to suit roof framing spacing indicated on Drawings.

2. APA Rated.
3. Nominal Thickness: As indicated on Drawings.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: As required to suit roof framing spacing indicated on Drawings.
2. APA Rated.
3. Nominal Thickness: As indicated on Drawings.

2.7 RADIANT BARRIER ROOF SHEATHING

A. Radiant Barrier Roof Sheathing: Exposure 1, Structural I sheathing, installed per manufacturer's requirements.

1. Oriented-Strand-Board or Plywood, as indicated on Drawings.
2. Span Rating: As required to suit roof framing spacing indicated on Drawings.
3. APA Rated.
4. Nominal Thickness: As indicated on Drawings.
5. Reflective Face: Heat resistant aluminum foil.

- a. Emittance Rating: 0.05 or less per ASTM C1371

2.8 SUBFLOORING AND UNDERLAYMENT

A. Oriented-Strand-Board Subflooring: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24 o.c. or 48/24.
2. Tongue-and-Groove edges.
3. APA Rated.
4. Nominal Thickness: Not less than **23/32 inch**.

B. Plywood Subflooring: Exposure 1, Structural I sheathing.

1. Span Rating: As required to suit floor framing spacing indicated on Drawings.
2. Tongue-and-Groove edges.
3. APA Rated.
4. Nominal Thickness: Not less than **23/32 inch**.

C. Underlayment, General: Provide gypsum concrete floor topping underlayment as indicated on Drawings per Division 03, Section 035500.

2.9 DRAFTSTOPPING

A. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.

1. Type and Thickness: Regular, **1/2 inch** thick, where indicated on Drawings.
2. Edge and End Configuration: Square.
3. Size: **As required** for vertical or horizontal installation or as required for coordination with framing and to comply with the specified fire rated assembly.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: As required to suit stud spacing indicated on Drawings.
2. APA Rated.
3. Nominal Thickness: As indicated on Drawings.

2.10 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture, as indicated on the Drawings, and as required by the Authority Having Jurisdiction.

1. Fasteners used for roof and wall sheathing including preservative-treated or fire-retardant-treated wood sheathing or into treated wood framing must be hot-dip zinc coated complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

2.11 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

2.12 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01, ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. "Fastening Schedule," in the Building Code.
- D. Use common wire nails unless otherwise indicated. 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. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated. Install per manufacturer's recommendations and applicable code requirements.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch** apart at edges and ends.
 - 2. Wall, Roof Sheathing, and Draftstopping:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch** apart at edges and ends.
 - d. Install fasteners **3/8 inch** to **1/2 inch** from panel edges.

- e. Space fasteners in compliance with requirements of authority having jurisdiction.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with screws, as indicated on Drawings.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install boards with a **3/8-inch** gap where non-load-bearing construction abuts structural elements.
 - 4. Install boards with a **1/4-inch** gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners approximately **7 inches** o.c. and set back a minimum of **3/8 inch** from edges and ends of boards.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners approximately **7 inches** o.c. and set back a minimum of **3/8 inch** from edges and ends of boards.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.

END OF SECTION 061600

SECTION 061753 - SHOP FABRICATED TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wood roof trusses.
 - 2. Wood floor trusses.
 - 3. Wood girder trusses.
 - 4. Wood truss bracing.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: As indicated.
 - 2. Serviceability deflection requirements. As Indicated.

1.4 SUBMITTALS

- A. Shop Drawings: Submit complete truss system design calculations for each truss and a placement plan, prepared by or under the supervision of, and signed and sealed by, a registered Professional Engineer, licensed in the State of the authority having jurisdiction. Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 5. Show splice details and bearing details.
 - 6. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer, licensed to practice in the jurisdiction where the trusses will be installed, responsible for their preparation.
 - 7. Show all truss to truss connections with details.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Source Limitations for Connector Plates: Obtain metal connector plates from a single manufacturer.
- D. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect stored trusses prior to installation for trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.7 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Provide dressed lumber, S4S.
 - 3. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- C. Minimum Chord Size For Roof Trusses: 2 by 4 inches nominal for both top and bottom chords.
- D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 6 Section "Rough Carpentry."

2.2 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1.
- B. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
 - 1. Use for interior locations where stainless steel is not indicated.

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.

- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.4 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

- F. Space trusses 24 inches o.c. maximum or as otherwise indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated on the wood truss shop drawings.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Division 6 Section "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not cut or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.

3.2 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

SECTION 062013 - EXTERIOR FINISH CARPENTRY

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 lumber standing and running trim.

1.3 INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
 - 1. For exterior ornamental wood columns, comply with manufacturer's written instructions and warranty requirements.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

2.2 STANDING AND RUNNING TRIM

- A. Lumber Trim for Painted Finish:
 - 1. Species and Grade: Southern pine, Grade No. 2, (Balcony T-Bar locations per Drawings, pressure-preservative treated, kiln dry after treatment-KDAT).
 - 2. Maximum Moisture Content: 19 percent.
 - 3. Finger Jointing: Not allowed.
 - 4. Face Surface: Smooth

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than **1-1/2 inches** into wood substrate.
 - 1. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
 - 2. For applications not otherwise indicated, provide hot-dip galvanized steel fasteners.
- B. Flashing: Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
- C. Sealants: Comply with applicable requirements in Division 07 Section "Joint Sealants"; recommended by sealant manufacturer and manufacturer of substrates for intended application.
- D. Painting: Comply with applicable requirements in Division 09 Section "Painting" and recommendations by the trim or molding manufacturer for priming and painting.

2.4 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than **5 inches**, except members with ends exposed in finished work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet,

moisture damaged, and mold damaged.

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

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime exterior finish carpentry material to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 09 Section "Painting" and manufacturer's recommendations.

3.3 INSTALLATION, GENERAL

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

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install flat grain lumber with bark side exposed to weather.
- B. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than **24 inches** long except where necessary.
 - 1. Use scarf joints for end-to-end joints, (butt joints where trim is covered with metal).
 - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Unless otherwise indicated, countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.

3.5 ADJUSTING

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

3.6 CLEANING

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

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062013

SECTION 062023 - INTERIOR FINISH CARPENTRY

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. Interior standing and running trim.
 - 2. Window sills.

1.3 INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
- B. Hardboard: AHA A135.4.
- C. MDF: ANSI A208.2, Grade 130.

2.2 STANDING AND RUNNING TRIM

- A. Moldings for Opaque Finish (Painted): Made to patterns included in WMMPA WM 12.
 1. Softwood Moldings: WMMPA WM 4, P-grade.
 - a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
 - b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - c. Primed: Factory pre-primed.
 2. Optional Material: Primed MDF.
 3. Finger Jointing: Allowed.
 4. Base Pattern: Style and size as indicated or specified by the Interior Designer or Owner.
 5. Casing Pattern: Style and size as indicated or specified by the Interior Designer or Owner.
 6. Other moldings as indicated on Drawings or specified by the Interior Designer or Owner.
- B. Softwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA WM 4, N-grade wood moldings. Made to patterns included in WMMPA WM 12.
 1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
 2. Maximum Moisture Content: 15 percent.
 3. Base and Casing Pattern: As indicated on Drawings or specified by the Interior Designer or Owner.
 4. Other moldings as indicated on Drawings or specified by the Interior Designer or Owner.

2.3 WINDOW SILLS

- A. Window sills shall be as indicated by the Interior Designer or Owner, size as indicated on the Drawings or as required for proper installation.
 - 1. Finishes: To be selected by the Interior Designer or Owner.

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
 - 1. Where galvanized finish is indicated, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.
- B. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.5 FABRICATION

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:
 - 1. Interior standing and running trim except shoe and crown molds.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

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

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than **24 inches** long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 1. Install trim after gypsum board joint finishing operations are completed.

3.5 ADJUSTING

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

3.6 CLEANING

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

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during remainder of the construction period.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

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

END OF SECTION 062023

SECTION 071330 - SHEET AND SPRAY-APPLIED WATERPROOFING

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 provisions for the following types of waterproofing systems:
 - 1. Modified bituminous self-adhering sheet membrane waterproofing.
 - 2. Spray-applied waterproofing membrane system.
 - 3. Bentonite waterproofing.

1.3 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is approved, licensed by, or otherwise acceptable to waterproofing manufacturer for installation and providing of warranty for waterproofing required for this Project.
- B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.
- C. Verification of Product Selections / Applications for Project Conditions: Verify with selected product manufacturer and coordinate all installation conditions indicated or encountered to verify that materials and details are appropriate for conditions. Notify Architect or Owner when conditions vary from those on Drawings, and when other problems might be anticipated in order to achieve proper waterproofing. Verify that proper remedies have been agreed to prior to beginning installations.
- D. Mockups: When requested or required by Owner, Owner's Waterproofing Consultant, or Architect, before beginning installation, install waterproofing to 100 sq. ft. of

designated building surface to demonstrate surface preparation, crack and joint treatment, corner treatment, and execution quality.

1. If Owner, Owner's Consultant, or Architect determines mockups do not comply with requirements, reapply waterproofing until mockups are approved.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 1. Do not apply waterproofing in rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
 1. Failure includes, but is not limited to, failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
 2. Warranty Period: Five years from date of Substantial Completion.

- B. Special Installer's Warranty: Provide Installer's warranty form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and when required, formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction. For use on horizontal floor surfaces like balconies and breezeways.

1. Physical Properties:

- a. Thickness: 60 mils; ASTM D3767.
- b. Tensile Strength: 325 psi minimum; ASTM D 412.
- c. Elongation: 350 percent minimum; ASTM D 412.
- d. Low-Temp Flexibility: Unaffected at -45 deg F; ASTM D 1970, 1" mandrel.
- e. Puncture Resistance: 60 lbs. minimum; ASTM E 154.
- f. Hydrostatic-Head: 230 feet; ASTM D 5385.
- g. Water Absorption: 0.1 percent by weight; ASTM D 570.
- h. Permeance: 0.05 perm; ASTM E 96.

2.2 SPRAY-APPLIED RUBBERIZED MEMBRANE

- A. Water-based, asphalt emulsion modified with a blend of synthetic rubbers and special additives, cures rapidly to a monolithic, highly flexible waterproofing membrane, for vertical or horizontal surfaces, for example; building stem wall foundations, retaining walls, balcony and breezeway floors, etc. Provide and install protection board per manufacturer's written specifications.

1. Physical Properties:

- a. Cured Film Thickness: 60 mils, minimum.
- b. Elongation: Not less than 500 percent; ASTM D 412.
- c. Resilience: 98 percent recovery; ASTM D 3407.
- d. Permeance: Not more than 0.1 perm; ASTM E 96, Method B.

2.3 BENTONITE WATERPROOFING

- A. The Geotextile/Bentonite clay waterproofing membrane shall consist of geotextile panels of sodium bentonite clay sandwiched between two layers of needle-punched woven and non-woven polypropylene fabrics. For use at below-grade structural slabs and foundations walls, for example at elevator pits and basement walls.

1. Physical Properties for Geotextile/Bentonite Clay Waterproofing Membrane:

	Property	Test Method	Value
a.	Bentonite Content	—	1.0 lb./ft ² (.488 kg/m ²)*

b.	Nominal Dry Thickness	—	0.25 in. (6.4 mm)
c.	Weight	—	75 lb./ft ² (34.05 kg/m ²)
d.	Permeability	ASTM D 5084	5 x 10 ⁻⁹ cm/sec
e.	Grab Tensile Strength	ASTM D 4632	95 lb. (422 N)
f.	Grab Elongation	ASTM D 4632	150%
g.	Puncture Resistance	ASTM D 4833	120 psi (828 kPa)
h.	Hydrated Internal Shear	ASTM D 5321	500 psf (24 kPa)
i.	Swell Index	ASTM D 5890	2g (24 ml) min.
j.	Fluid Loss	ASTM D 5891	18 ml max

*@ 12% moisture content

2.4 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with the waterproofing system.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Sheet Strips for Concealed Flashings: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing. Do not use modified bituminous waterproofing membrane for exposed sheet flashings.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
- I. Protection Board: Per waterproofing manufacturer's written specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide structurally sound, clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 1. Unless otherwise required by manufacturer, install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- F. As applicable, bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips, or as otherwise required by manufacturer for indicated conditions.
 1. Except when unacceptable to manufacturer, invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 1. Unless required otherwise, install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 INSTALLATION

- A. Install waterproofing system as indicated on the Drawings and according to waterproofing manufacturer's written instructions.

- B. Coordinate installing waterproofing materials with associated work to provide complete system complying with combined recommendations by manufacturers and installers involved in Work. Schedule installation to minimize exposure of sheet waterproofing materials.
- C. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fish-mouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- D. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 FIELD QUALITY CONTROL

- A. When required by conditions of required Warranty, engage a full-time, or when acceptable, part-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, related components and protection; and to furnish daily reports to Owner and Architect.

3.5 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071330

SECTION 071800 - TRAFFIC COATINGS - PEDESTRIAN

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 traffic coatings for the following applications:
 - 1. Pedestrian traffic coating system.
 - a. For Breezeway/Corridor floors and Balconies.

1.3 PREINSTALLATION MEETINGS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product, including installation instructions.
- B. Samples for Initial Selection: For each type of exposed finish.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.

1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
- B. Do not install traffic coating until items that penetrate membrane have been installed.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Material Compatibility: Provide primers; base-, intermediate-, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Source Limitations:
 1. Obtain traffic coatings from single source from single manufacturer.
 2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.

2.2 PEDESTRIAN TRAFFIC COATING

- A. Pedestrian Traffic Coating: Manufacturer's standard, two-component, polymer-modified, waterproof, cement-based coating system that provides non-slip texture surfaces. For color finish, use the manufacturer's acrylic top coat.
 1. Basis-of-Design Product: Sika Corp., Sikagard FlexCoat, cementitious protective coating. For color finish; Sikagard FlexCoat ATC acrylic top coat. Product includes the following:
 - a. Rubber-like polymer liquid.
 - b. Cement aggregate blend.
 - c. Acrylic top coat for color finish.
 - 1) Color: As selected by Owner or Interior Designer.
 2. Physical Properties of Sikagard FlexCoat:
 - a. Adhesion: 515 psi, ASTM C-882, Type I.
 - b. Compressive Strength: 2,440 psi, ASTM C-109.

- c. Tensile Strength: 430 psi, ASTM C-190.
- d. Elongation: 12%, ASTM D-412.
- e. Water Vapor Permeability: 1.96 perms/inches, E-96.
- f. Fire Resistance: Class A, UL790.

2.3 ACCESSORY MATERIALS

- A. Joint Sealants: Compatible joint sealants per manufacturer.
- B. Sheet Flashing: As recommended by the manufacturer.
- C. Adhesive: Contact adhesive recommended in writing by traffic-coating manufacturer.
- D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic-coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of traffic-coating work.
- B. Verify that substrates are visibly dry and free of moisture.
 - 1. Test for moisture according to ASTM D 4263.
 - 2. Test for moisture content by method recommended in writing by traffic-coating manufacturer.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
- D. Proceed with installation only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. General: Before applying traffic coatings, clean and prepare substrates according to manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- B. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

- C. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.
- D. Concrete Substrates: Do not acid etch.
 - 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - 2. Remove concrete fins, ridges, and other projections.
 - 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written instructions.
- B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
- D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.
- B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 TRAFFIC-COATING APPLICATION

- A. Apply traffic coating according to manufacturer's written instructions.
- B. Apply number of coats of specified compositions for each type of traffic coating at locations as indicated on Drawings or otherwise recommended by the manufacturer.
- C. Start traffic-coating application in presence of manufacturer's technical representative.
- D. Verify that wet film thickness of each coat complies with requirements every 100 sq. ft.

- E. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.
- F. Cure traffic coatings. Prevent contamination and damage during application and curing stages.

3.6 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071800

SECTION 071900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes clear penetrating sealer water-repellent treatments for the following vertical surfaces:

- 1. Cast-in-place concrete.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Ready-to-use premium low gloss sealer that penetrates deeply to seal and protect bare concrete. Durable urethane-fortified acrylic sealer with low odor, and low VOCs, easy to work with and safe for the environment. Excellent chemical resistance and repels stains.

- 1. Basis-of-Design: Clear-Seal by Seal Krete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.
- C. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply coating of water repellent on surfaces to be treated per manufacturer's recommendations.

3.4 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 072100 – THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes the following products where required or as indicated on the Drawings:
 - 1. Glass-fiber blanket (thermal or acoustical) insulation.
 - 2. Mineral-wool (fire-safing or acoustical) insulation.
 - 3. Loose-fill insulation.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

- A. General: Provide insulating materials which comply with requirements indicated for materials, R-values or thickness indicated on Drawings, compliance with referenced standards, and that meet or exceed the requirements of the State Energy Efficiency Code.

2.2 GLASS-FIBER BLANKET (THERMAL OR ACOUSTICAL) INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work shall provide products that comply with the following.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. ASTM C 423 for acoustical performance, (performance varies depending on application, thickness, and density).

2.3 MINERAL-WOOL (FIRE-SAFING OR ACOUSTICAL) INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work shall provide products that comply with the following.
- B. Reinforced-Foil-Faced, Mineral-Wool Fire-Safing Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
- C. Unfaced, Mineral Wool (Rockwool) Blanket Acoustical Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 0 and 0, respectively, per ASTM E 84; passing ASTM E 136 for non-combustion characteristics; ASTM C 423 for acoustical performance, with 2 to 3 lb. per cubic foot density.

2.4 LOOSE-FILL INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work shall provide products that comply with the following.
- B. Cellulosic-Fiber Loose-Fill Insulation: ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics.
- C. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

2.5 MISCELLANEOUS MATERIALS

- A. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.
- B. Ties or Strapping: Provide plastic ties or strapping as required to secure acoustical insulation around vertical plumbing waste stacks as directed by Owner.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
- E. 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.
- F. Fire Rated Assemblies: Insulation in fire rated assemblies shall be installed to comply with the requirements of the tested assembly.
- G. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Blanket and Mineral-Wool Fire Safing Insulation: Install in cavities formed by framing members according to the following requirements and where indicated on Drawings:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 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** clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install blankets according to ASTM C 1320.
6. For metal-framed wall cavities where cavity heights exceed **96 inches**, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.4 INSTALLATION OF ACOULSTICAL INSULATION

- A. Where glass-fiber blankets are indicated for sound attenuation, install blanket insulation in thicknesses indicated.
 1. Insulation in fire rated assemblies shall be installed to comply with the requirements of the tested assembly.
- B. Install glass-fiber blankets as acoustical insulation around vertical plumbing waste piping in locations as directed by the Owner. Owner to field approve prior to drywall installation.

3.5 INSTALLATION OF LOOSE-FILL INSULATION

- A. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
 1. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."

3.6 PROTECTION

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

END OF SECTION 072100

SECTION 072500 - WEATHER BARRIERS

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. Weather resistive barrier, (building wrap).
 - 2. Flashing tape, (peel and stick), self-adhering flashing.
 - 3. Flexible flashing.
 - 4. Self-adhering underlayment.
 - 5. Fluid-applied (roller grade) waterproof coating.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For building wrap, seam tape, fasteners, flashing, and flexible flashing.
 - a. Include data on air and water-vapor permeance based on testing according to referenced standards for building wrap.

PART 2 - PRODUCTS

2.1 WEATHER RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I, non-perforated, nonwoven, non-absorbing, breathable, spun-bonded polyolefin membrane; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work, shall comply with the following.
 - a. Performance Characteristics:
 - 1) Drainage Efficiency: 90% or greater, when tested in accordance with ASTM E2273.
 - 2) Water Vapor Transmission: 50 perms or greater, when tested in accordance with ASTM E96, Method B.
 - 3) Water Penetration Resistance: Minimum 250 cm when tested in accordance with AATCC-127.

- 4) Air Permeance: Not more than 0.004 cfm/sq. ft. at 1.57 psf when tested according to ASTM E 2178. Type I per ASTM E1677.
 - 5) Air Resistance: Air infiltration at 1000 seconds or greater, when tested in accordance with TAPPI Test Method T-460.
 - 6) Tensile Strength: Minimum 30/30 lbs/in., when tested in accordance with ASTM D882, Method A.
 - 7) Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: less than 25, Smoke Developed: less than 450.
- B. Building-Wrap Seam Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLASHING TAPE

- A. Flashing Tape: Self-adhering flashing tape (peel and stick), high performance, butyl rubber adhesive with non-woven polyolefin backing and coated Kraft paper release. Flashing to be used around windows, doors, and other exterior penetrations to prevent water and air intrusion. Flashing to be compatible with building wrap product as recommended by the building wrap manufacturer and with all other associate building materials including sealants. Provide minimum 6 inch wide flashing unless otherwise indicated on Drawings to extend 2" beyond finish trim.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work, shall comply with the following.
 - a. Thickness: Flashing Tape, 20 mil thickness minimum.

2.3 FLEXIBLE FLASHING

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber adhesive, with a creped cross-laminated polyolefin backing and polyethylene film release. Provide the, type and width of, flexible flashing product as required to comply with installation conditions or as indicated on Drawings.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work, shall comply with the following.
 - a. Thickness: Flexible Flashing, 60 mil thickness minimum.

2.4 SELF-ADHERING UNDERLAYMENT

- A. Where required for wide self-adhering flashing installation, such as outside exterior wall corners, self-adhering waterproof underlayment material shall be used and cut to size indicated on the Drawings.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work, shall comply with the following:
 - a. Thickness: Self-adhering underlayment, 40 mil thickness minimum.

2.5 FLUID APPLIED (ROLLER GRADE) WATERPROOF COATING

- A. Where required for vertical or horizontal applications, such as window openings, waterproof coating material shall be used where indicated on the Drawings.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work, shall comply with the following:
 - a. Vertical Hold: > 50 mils.
 - b. Tensile per ASTM D 412: 220-240 psi.
 - c. Elongation per ASTM D 412: 600-700%.
 - d. Permeability per ASTM E 96: 0.1 perm-inches.

2.6 MISCELLANEOUS MATERIALS

- A. Primer for Flashing: Product recommended by manufacturer of flashing for substrate.
- B. Fasteners: Provide and install building wrap using fasteners as specified in writing by the building wrap manufacturer.
- C. Compatibility with Sealants: Provide and install flashing products compatible with sealants as specified in Division 07, Section "Joint Sealants", and as recommended by the flashing manufacturer.

PART 3 - EXECUTION

3.1 WEATHER BARRIER INSTALLATION

- A. Install per manufacturer's installation instructions and as required per the Authority Having Jurisdiction.
- B. Cover exposed exterior surface of sheathing with weather barrier securely fastened to framing immediately after sheathing is installed.
- C. Cover sheathing with weather barrier as follows:
 - 1. Cut back barrier **1/2 inch** on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum **4-inch** overlap unless otherwise indicated.
- D. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLASHING INSTALLATION

- A. Apply flashing and flexible flashing where indicated, or where required if not indicate, to provide a permanently watertight and weather resistant installation and to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least **4 inches** except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 073113 - ASPHALT SHINGLES

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. Asphalt shingles.
 - 2. Underlayment.
 - 3. Off-Ridge roof vents.
 - 4. Ridge vents, where applicable.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, provide manufacturer's printed product information indicating material characteristics, performance criteria, and product limitations.
- B. Manufacturer's Installation Instructions: Provide published instructions that indicate preparation required and installation procedures.
- C. Samples: For asphalt shingles, submit full range of samples for color and texture to Architect for selection by Owner.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.
 - 1. Submit State Product Approval documentation as required by the Authority Having Jurisdiction.
- B. Research/Evaluation Reports: For each type of asphalt shingle required, from the ICC.
- C. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS (TO OWNER)

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: 100 sq. ft. of each type, in unbroken bundles.

1.7 QUALITY ASSURANCE

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

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture according to manufacturer's written instructions.
- B. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Install roofing products within the range of ambient and substrate temperatures recommended in writing by manufacturer.
 - 1. Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.
- B. WARRANTY
- C. Manufacturer's Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
 - 1. Material Warranty Period: **30** years, minimum, from date of Substantial Completion, prorated, with first 5 years minimum, non-prorated.
 - 2. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor **10** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

2.2 MANUFACTURERS / PRODUCTS

- A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Dimensional Style Asphalt Shingles: Laminated double-layer fiberglass mat construction with a random-cut saw-tooth design and a self-sealing strip of asphalt. ASTM D 3462, ASTM E 108 and UL 790 Class A Fire Resistance, ASTM D 3161, Type-I, Class F Wind Resistance, ASTM D 7158 Class H Wind Resistance, with algae resistant protection.
- B. Color: As selected by the Architect or Owner.
- C. Hip and Ridge Shingles: Shingle manufacturer's recommended product for capping hips and ridges. Color to match roof shingle product.

2.4 UNDERLAYMENT MATERIALS

- A. Felt Underlayment: ASTM D 226 Type II or D 4869 Type IV, No. 30, asphalt-saturated organic felts, non-perforated.
- B. Alternate Synthetic Underlayment: Meet or exceed ASTM D 226 Type II felt or D 4869 Type IV felt, Code Evaluation Report for code compliance or Product Approval as required by AHJ and must be acceptable to roof covering manufacturer. Minimum performance requirements to be as follows:
 - 1. Permeability ASTM E96; .05 perms.
 - 2. Tear Strength ASTM D4533; MD 26 lbs / CD 24 lbs.
 - 3. Tensile Strength ASTM D751; MD 88 lbs / CD 70 lbs.
 - 4. Burst Strength ASTM D751; 158 psi.
 - 5. Nominal Thickness ASTM D1777; 7 mils.
- C. Self-Adhering Sheet Underlayment, High Temperature (for Valley Liner and Counter Flashing where indicated on Drawings): Minimum of 30- to 40-mil- thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified

asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

2.5 OFF-RIDGE ROOF VENTS (where indicated on the Drawings)

- A. Galvanized metal off-ridge vents. Color to match shingles as approved by Owner or paint to Owner specifications.
- B. Standard Off-Ridge Vents: Provide vents with a baffle for windblown rain to comply with Code requirements for installation and for net free air space, in sizes as indicated on the Drawings:
- C. Where building mean roof height exceeds manufacturer's limitations and conditions of use, the Contractor shall request a signed and sealed letter from the manufacturer's registered engineer, (licensed in the State of the AHJ), indicating installation requirements for compliance with Code.
 1. The letter shall be submitted to the Architect and to the AHJ for approval.

2.6 RIDGE ROOF VENTS (where indicated on the Drawings)

- A. Ridge Vents: Continuous rigid section high-density polypropylene or other UV-stabilized plastic ridge vent for use under ridge shingles. Comply with code requirements for net free air space, in locations as indicated on the Drawings.

2.7 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, sharp-pointed, with a minimum 3/8-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.
 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt-Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.
- D. Synthetic-Underlayment Fasteners: As recommended in writing by synthetic-underlayment manufacturer for application indicated.

2.8 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."
- B. 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 the item.
 - 1. Apron Flashings: Fabricate with lower flange a minimum of 4 inches over and 4 inches beyond each side of down-slope asphalt shingles and 6 inches up the vertical surface.
 - 2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 4 inches over the underlying asphalt shingle and up the vertical surface.
 - 3. Cricket Flashings: Fabricate with concealed flange extending a minimum of 18 inches beneath upslope asphalt shingles and 6 inches beyond each side of chimney and 6 inches above the roof plane.
 - 4. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

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.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provisions have been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

- B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt-underlayment nails.
1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction that sheds water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.
 2. Install fasteners at no more than 36 inches o.c.
- C. Synthetic Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides and ends and treat laps as recommended in writing by manufacturer. Stagger end laps between succeeding courses at interval recommended in writing by manufacturer. Fasten according to manufacturer's written instructions. Cover underlayment within period recommended in writing by manufacturer.
1. Install in single layer on roofs sloped at 4:12 and greater.
 2. Install in double layer on roofs sloped at less than 4:12.
- D. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install lapped in direction that sheds water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 2. Eaves: Extend from edges of eaves 24 inches beyond interior face of exterior wall.
 3. Rakes: Extend from edges of rake 24 inches beyond interior face of exterior wall.
 4. Valleys: Extend from lowest to highest point 18 inches on each side.
 5. Hips: Extend 18 inches on each side.
 6. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
 7. Sidewalls: Extend beyond sidewall 18 inches, and return vertically against sidewall not less than 4 inches.
 8. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches, and return vertically against penetrating element not less than 4 inches.
 9. Roof Slope Transitions: Extend 18 inches on each roof slope.
- E. Concealed Valley Lining: For woven valleys. Comply with NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems." Install underlayment centered in valley and fastened to roof deck.
1. Lap roof-deck underlayment over valley underlayment at least 6 inches.
 2. Install a full-width sheet of synthetic underlayment centered in valley. Lap ends of strips at least 12 inches in direction to shed water, and seal with asphalt roofing cement. Fasten to roof deck.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 07, "Sheet Metal Flashing and Trim."
 - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- D. Cricket or Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
- E. Rake Drip Edges: Install rake drip-edge flashings over underlayment and fasten to roof deck.
- F. Eave Drip Edges: Install eave drip-edge flashings below underlayment and fasten to roof sheathing.
- G. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT-SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt-shingle strip with tabs removed with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- E. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.

- F. Fasten asphalt-shingle strips according to Code requirements and manufacturer's written instructions.
- G. Woven Valleys: Extend succeeding asphalt-shingle courses from both sides of valley 12 inches beyond center of valley, weaving intersecting shingle-strip courses over each other. Use one-piece shingle strips without joints in valley.
 - 1. Do not nail asphalt shingles within 6 inches of valley center.
- H. Closed-Cut Valleys: Extend asphalt-shingle strips from one side of valley 12 inches beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt-shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline. Trim upper concealed corners of cut-back shingle strips.
 - 1. Do not nail asphalt shingles within 6 inches of valley center.
 - 2. Set trimmed, concealed-corner asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.
- I. Off-Ridge Roof Vents (where indicated on Drawings): Install to comply with Code and according to manufacturer's written instructions. Fasten with **screws and fender washers at 16 inches o.c.** of sufficient length to penetrate sheathing.
- J. Ridge Vents (where indicated on Drawings): Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- K. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent, (where applicable), without obstructing airflow.

END OF SECTION 073113

SECTION 074113 - METAL ROOF 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. Standing-seam metal roof panels.
 - 2. Underlayment.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Water Penetration: No water penetration when tested according to ASTM E 2140.
- C. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with wind-uplift-resistance for the wind load as indicated on the Drawings.
- D. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads within limits and under conditions indicated, based on testing according to ASTM E 1592, UL 580, Class 90 wind uplift.
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure as indicated on Drawings.
- E. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

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 type of roof panel and accessory.
- B. Manufacturer's Installation Instructions: Provide published instructions that indicate preparation required and installation procedures.

- C. Samples: For metal roof panels, submit full range of samples for color and texture to Architect for selection by Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Product test reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for metal roof panels.
 - 1. Submit State Product Approval documentation as required by the Authority Having Jurisdiction.
- B. Research/Evaluation Reports: For each type of metal roof panel required, from the ICC.
- C. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.9 COORDINATION

Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leak-proof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 40 years from date of Substantial Completion.
- B. Special Installer's Warranty: Specified form in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within 5 years from date of Substantial Completion.
- C. Special Weather-tightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace roof panel assemblies that fail to remain weathertight within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers that may be incorporated into the Work as approved or selected by the Owner and subject to the Architect's review.
 - 2. Material: 24 gauge AZ-50 Galvalume (Painted).
 - a. Texture: Smooth
 - b. Pan Coverage: 16 inches.
 - c. Seam Height: 1.75 inch.
 - d. Color: As selected by Owner or Architect from manufacturer's full range.
- B. Clips: Manufacturer's standard.
- C. Panel Sealants: Provide manufacturer's standard recommended products.

2.2 UNDERLAYMENT MATERIALS

- A. General: Provide underlayment materials as recommended by the metal roofing manufacturer. Underlayment materials include, but are not limited to, the following:
- B. Self-Adhering, High-Temperature Underlayment: Self-adhering, cold-applied, sheet underlayment, a minimum of **30 mils** thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
- C. Felt Underlayment: ASTM D 226/D 22M, Type II (No. 30), asphalt-saturated organic felt.

2.3 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws, bolts, 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 roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 ACCESSORIES

- A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
 2. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- B. Flashing and Trim: Formed from same material as roof panels, pre-painted with coil coating, minimum 0.018 inch thick. Provide 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, fascia, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.
- C. Drip edge and fascia to match metal roofing.

2.5 FABRICATION

- A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. 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. End Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate 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 of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.6 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: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.
- B. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
- C. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

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

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Miscellaneous Framing: Install other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof area where metal roof panels shall be installed.
- B. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.4 METAL ROOF PANEL INSTALLATION, GENERAL

- A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
- B. Install per the manufacturer's written instructions.
- C. Fasteners: Per manufacturer's written instructions.
- D. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- E. 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 rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
 - 1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
- F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealers."

3.5 FIELD QUALITY CONTROL

- A. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

3.6 CLEANING

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

END OF SECTION 074113

SECTION 074700 - EXTERIOR COMPONENTS

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. Soffit and soffit vents.
 - 2. Decorative shutters.
 - 3. Architectural simulated millwork.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings & Calculations: Where applicable, include plans, elevations, sections, details, attachments to other work, and calculations.
 - 1. For installed products indicated to comply with design loads, submit complete shop drawings and calculations prepared by, or under the supervision of, and signed and sealed by, a Professional Engineer registered in the State of the authority having jurisdiction.

1.4 PERFORMANCE REQUIREMENTS

- A. Code Compliance: Where applicable, conform to local Building Code requirements and product approval as required by the authority having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Except as required or approved otherwise, obtain each type, color, texture, and pattern of material, including related accessories, through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in a dry, well-ventilated, weather-tight place and as required by the manufacturer.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

1.8 COORDINATION

- A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.9 WARRANTY

- A. Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace material that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, cracking, deforming, or otherwise deteriorating beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS / PRODUCTS

- A. Product: Provide products by a manufacturer subject to compliance with requirements and approval of the Architect and Owner.

2.2 SOFFIT AND SOFFIT VENTS

- A. Soffit: Perforated soffit providing continuous attic ventilation, as indicated on the Drawings. Non-perforated soffit for non-ventilated areas, as indicated on the Drawings.
 - 1. Material: Fiber-cement, as indicated on the Drawings.
 - 2. Perforated soffit: Style as indicated on the Drawings or as otherwise selected by the Owner. Ventilation requirements as indicated on the Drawings.
 - a. Install aluminum screen for additional insect protection, 18x16 mesh, .011 gauge to back side of panel over vent holes and overlap non-vented area of panel by a minimum of 1 inch. Secure screen to panel with construction adhesive.
 - b. Install additional vents as indicated on Drawings to provide additional ventilation as required to comply with Code.
 - 3. Non-perforated soffit: Style as indicated on the Drawings or as otherwise selected by the Owner.
 - 4. Color: White or as otherwise selected by the Owner.

2.3 DECORATIVE SHUTTERS

- A. Decorative Foam Shutters: Where indicated on the Drawings, provide decorative shutters that are durable polyurethane, factory molded and primed with manufacturer's standard primer.
 - 1. Size and style as indicated on the Drawings or selected by the Owner.
 - 2. Molded urethane product, produced for exterior use, with a tough outer skin on exposed surfaces.

2.4 ARCHITECTURAL SIMULATED MILLWORK

- A. Simulated Millwork: Urethane millwork, factory molded and primed with manufacturer's standard primer.
 - 1. Urethane Moulding Products:
 - a. Molded urethane product, produced for exterior use, in shapes indicated, with a tough outer skin on exposed surfaces; factory primed, and not for shaping exposed surfaces after molding.
 - b. Patterns: Millwork designs in the style and size as indicated on Drawings.

2.5 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Flashing: Provide aluminum flashing complying with Division 07 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
- B. Elastomeric Joint Sealant: Single-component urethane sealant complying with requirements in Division 07 Section "Joint Sealants."
- C. Fasteners: Use fasteners compatible with the product being installed, as recommended by the product manufacturer.
- D. Adhesive: Use adhesive compatible with the product being installed, as recommended by the product manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurement: Confirm site dimensions prior to manufacturing.
- B. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Replace soffit material and other items that are damaged or do not comply with requirements. Items may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.
- C. Clean finished surfaces according to the manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074700

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

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. Adhered thermoplastic polyolefin (TPO) membrane roofing system.

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, fabrication, 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 based on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
- D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
- E. Solar Reflectance Index: Not less than **78** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- G. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than **.70** and an emissivity of not less than **.75** when tested according to CRRC-1.

1.4 ACTION 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.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and FM Approvals approved 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 product and that is eligible to receive manufacturer's special warranty.
- C. Source Limitations: Obtain components including roof insulation fasteners for membrane roofing system from same manufacturer as membrane roofing.
- D. 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.
- E. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing.
 - 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 roof observation and repair procedures after roofing installation.

1.7 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 location and within the temperature range required by roofing system manufacturer. Protect 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 other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.8 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.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without 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, fasteners, roofing accessories, and other components of membrane roofing system.
 - 2. Warranty Period: 20 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. Fully adhered roofing system.
 - 1. Manufacturer: Subject to compliance with requirements, provide manufacturers offering products that may be incorporated into the Work acceptable to the Owner and pending review by the Architect.
 - 2. Thickness: 60 mils, nominal.
 - 3. Physical Property:
 - a. Breaking Strength: 250 lbf min.
 - b. Tearing Strength: 55 lbf min.
 - c. Puncture Resistance: 300 lbf min.
 - 4. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials 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 sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

- C. Bonding Adhesive: Manufacturer's standard.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- F. Cover Board: Provide cover board as indicated on Drawings and per manufacturer's recommendations.

2.3 ROOF BOARD UNDERLAYMENT

- A. General: Provide roof board underlayment material as specified on the Drawings and as recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

2.4 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 roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the manufacturer's requirements and other conditions affecting performance of roofing system.
- 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 projections.

3.3 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. 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.

- C. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- D. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- E. 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.

3.4 BASE FLASHING INSTALLATION

- A. Install sheet flashings 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 or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings.

3.5 WALKWAY INSTALLATION

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

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
 - 1. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography according to ASTM C 1153.
 - a. Perform tests before overlying construction is placed.
 - b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.

- c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.
- B. (Alternate Bid Testing): Provide alternate bid for Owner approval; Electronic Field Vector Mapping, (EPVM), testing to detect holes, voids, or penetrations through the TPO.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.7 PROTECTING 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 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.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Formed Products:

- a. Formed roof drainage sheet metal fabrications.
 - b. Formed steep-slope roof sheet metal fabrications.
 - c. Formed wall sheet metal fabrications.
 - d. Formed equipment support flashing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

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.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: **ASTM B 209**, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Surface: Smooth, flat.
 - 2. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - a. Color: As selected from the manufacturer's full range by the Owner or as required to match adjacent surfaces.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).
- D. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and pre-painted 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 and mill phosphatized for field painting.

2.2 UNDERLAYMENT MATERIALS

- A. As indicated on Drawings and as specified in other applicable Division 07 Sections.

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 and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

- C. Solder:
 - 1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- D. 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.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; low modulus; 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 emulsion complying with ASTM D 1187.
- 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, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than **1 inch** deep, filled with butyl sealant concealed within joints.

- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- H. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Provide continuous seamless gutter. Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. 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, and gutter accessories from same metal as gutters.
 - 1. Gutter Style: SMACNA designation K, (Ogee), unless otherwise indicated on the Drawings or as selected by the Owner.
 - 2. Expansion Joints: Lap type.
 - 3. Accessories: Valley baffles.
 - 4. Gutters to be 6 Inches wide, unless otherwise indicated on the Drawings.
 - 5. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.
- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Downspouts to be 3" x 4": Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: (26 gage) 0.022 inch thick.
- B. Fascia Trim: Fabricate from the following materials:
 - 1. Aluminum: 0.024 inch thick.
- C. Drip Edges: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- D. Eave, Rake Flashing: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.

E. Counter-flashing: Fabricate from the following materials:

1. Galvanized Steel: (26 gage) 0.022 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Wall Flashing in Frame Construction:

1. Apron, Base, Cap, Corner, Diverter, Edge, and Z- Flashing: Fabricate from Galvanized Steel: (26 gage) 0.022 inch thick.
2. Counter-flashing: Fabricate from Galvanized Steel: (26 gage) 0.022 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend beyond wall openings. Form head and sill flashing with 2-inch- high, end dams.

1. Fabricate from Aluminum: 0.024 inch thick.

C. Copings: Fabricate in minimum 96-inch long, but not exceeding 12-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, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Profile: As indicated on Drawings according to SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate from Aluminum: 0.050 inch thick.

D. Roof and Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials: Shop fabricate interior and exterior corners.

1. Fabricate from Aluminum: 0.050 inch thick.

E. Base Flashing: Shop fabricate interior and exterior corners

1. Fabricate from Aluminum: 0.040 inch thick.

F. Counterflashing: Shop fabricate interior and exterior corners.

1. Fabricate from Aluminum: 0.032 inch thick.

G. Roof-Penetration Flashing.

1. Fabricate from Stainless-Steel: 0.019 inch thick.

H. Roof-Drain Flashing.

1. Fabricate from Stainless-Steel: 0.016 inch thick.

2.8 FORMED EQUIPMENT SUPPORT FLASHING

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.
2. Galvanized Steel: 0.028 inch thick.

3. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.

3.3 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. Install sheet metal flashing and trim true to line and levels indicated or as required per industry standards for proper installation.
 2. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 3. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 4. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 5. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 6. Install sealant tape where indicated or as required.
 7. Torch cutting of sheet metal flashing and trim is not permitted.
 8. Do not use graphite pencils to mark metal surfaces.
 9. Install exterior flashing joints with 4" laps and full sealant embedment.
- 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 SMACNA or the manufacturer for this purpose.
 1. Coat back side of 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.
 3. **Mill finish aluminum or aluminum fasteners should not be used in direct contact with ACQ pressure-treated lumber. Aluminum products with Kynar painted finish may be used or spacer materials or other physical barriers**

are recommended to prevent direct contact of ACQ pressure-treated wood. Stainless steel fasteners shall be used.

- C. 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 watertight, form expansion joints of intermeshing hooked flanges, not less than **1 inch** deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than **1-1/4 inches** for nails and not less than **3/4 inch** for wood screws.
- E. Seal joints as shown and as required for watertight construction.

3.4 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 sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than **36 inches** apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
- C. Downspouts: Join sections with **1-1/2-inch** telescoping joints.
 - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately **60 inches** o.c. in between.
 - 2. Connect downspouts to underground drainage system indicated or provide elbows at base of downspout to direct water away from building to splash-block as otherwise indicated on Drawings.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal 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 and weather resistant.
- B. Counter-flashing: Coordinate installation of counter-flashing with installation of base flashing. Insert counter-flashing in reglets or receivers and fit tightly to base flashing. Extend counter-flashing **4 inches** over base flashing. Lap counter-flashing joints a minimum of **4 inches** and bed with sealant. Secure in a waterproof manner.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations, industry standards, and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers and as recommended by the manufacturer of the component.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. 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 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes the following where required or as indicated on the Drawings:
 - 1. Roof curbs.
 - 2. Equipment supports.
 - 3. Roof hatches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
- B. Shop Drawings: For roof accessories.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, integral metal cant, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 0.052 inch thick.
 - 1. Finish: Two-coat fluoropolymer.
 - 2. Color: As indicated by manufacturer's designations.
- D. Material: Aluminum sheet, 0.090 inch thick.
 - 1. Finish: Two-coat fluoropolymer Baked enamel or powder coat Insert finish.
 - 2. Color: As indicated by manufacturer's designations.
- E. Material: Stainless-steel sheet, 0.078 inch thick.
 - 1. Finish: Manufacturer's standard.
- F. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - 3. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 - 4. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 5. Nailer: Factory-installed wood nailer, continuous around curb perimeter.
 - 6. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
 - 7. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 8. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.2 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed structure-mounting flange at bottom.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 0.052 inch thick.
 - 1. Finish: Two-coat fluoropolymer.
 - 2. Color: As indicated by manufacturer's designations.
- D. Material: Aluminum sheet, 0.090 inch thick.
 - 1. Finish: Two-coat fluoropolymer.
 - 2. Color: As indicated by manufacturer's designations.
- E. Material: Stainless-steel sheet, 0.078 inch thick.
 - 1. Finish: Manufacturer's standard.
- F. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 - 3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 - 4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide, continuous around support perimeter.
 - 5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
 - 6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 - 8. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - 9. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.3 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated **[single]**-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
- B. Type and Size: Single-leaf lid, size as indicated on Drawings.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) steel sheet.
 - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - 2. Finish: Factory prime coating.
 - 3. Color: As indicated by manufacturer's designations.
- E. Construction:
 - 1. Insulation: Glass-fiber board.
 - a. R-Value: 12.0 according to ASTM C 1363.
 - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
- F. Hardware: Spring operators, hold-open arm, galvanized-steel spring latch with turn handles, galvanized-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
 - 1. Provide two-point latch on lids larger than 84 inches.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 - 1. Height: 42 inches above finished roof deck.
 - 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 - 3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
 - 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 - 5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
 - 6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.

7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.
11. Finish: Manufacturer's standard.
 - a. Color: As indicated by manufacturer's designations.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- E. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
- C. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Inspections: Installed firestopping systems shall be inspected by a third party inspector in accordance with FFPC, NFPA-1-2012 Fire Code Section 12.3.2, per Field Quality Control requirements specified herein.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

3.5 FIELD QUALITY CONTROL

- A. Contractor will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174 and E 2393, as applicable, in accordance with AHJ requirements for new buildings three stories or greater in height.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 079200-JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes, but is not limited to, sealants for the following applications and those specified by reference to this Section:
 - 1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 2. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 3. Insulating foam sealant.
 - 4. Acoustical joint sealant.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric polyurethane joint sealants for exterior applications 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Provide color of exposed joint sealants to match adjacent building material finish colors.

2.2 ELASTOMERIC POLYURETHANE JOINT SEALANTS (EXTERIOR CONDITIONS)

- A. Products: Subject to compliance with requirements, provide premium, very low-modulus, high-movement, non-sag, fast-curing, ready-to-use, elastomeric, silyl-terminated polyether, (STPE) sealant for **exterior conditions** complying with the following:
 - 1. One-Part Non-sag Elastomeric STPE Sealant: ASTM C 920 Type S, Grade NS, Class 50, Use NT, M, A, G, and O.
 - a. Color: As needed to match adjacent surfaces as close as possible.
 - 2. Alternate Sealant: One-Part Non-sag Elastomeric Polyurethane Sealant: ASTM C 920 Type S, Grade NS, Class 35 to 50, Use NT, M, A, G, and O.

2.3 JOINT SEALANTS (INTERIOR CONDITIONS)

- A. General: Products shall comply with low or zero VOC limits as necessary to comply with project requirements.
- B. Available Products: Subject to compliance with requirements, provide an acrylic-latex, gun-grade, general purpose elastomeric sealant for **interior conditions** complying with the following:
 - 1. Acrylic-Latex Sealant: ASTM C 834.
 - 2. Silicone Sealant: ASTM C 679, ASTM C 639, ASTM C 794, ASTM C 603, ASTM C 920, ASTM D 412.
 - 3. Color: As needed to match adjacent surfaces as close as possible.

2.4 INSULATING FOAM SEALANT

- A. Insulating Foam Sealant: For filling and sealing gaps up to 3 inches, (example: holes in the exterior wall through the exterior finish material for electrical wiring at electrical meter centers), the following product shall be incorporated in the Work:
 - 1. Expanding Single-Component Polyurethane Foam Sealant: ASTM E 84, ASTM E 814, ASTM C 203, ASTM D 1621, ASTM D 1623.

2.5 ACOUSTICAL JOINT SEALANT

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. 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.

2.6 JOINT-SEALANT BACKING

- A. Provide sealant backings of material and type that are non-staining; 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. Provide any type 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or joint-sealant-substrate tests 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.

3.2 INSTALLATION OF JOINT SEALANTS

- A. 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 bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. 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.
- G. Tooling of Non-sag 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.

3.3 FIELD QUALITY CONTROL

- A. Examination / Inspection
 - 1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements.

3.4 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.

3.5 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 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hollow metal swing doors and metal or wood frames, where indicated on the Drawings.
 - a. Exterior insulated metal swing doors.
 - 1) Including "French Door" patio doors, where required.
 - b. Fire-rated door and frame assemblies where required.
 - c. Impact rated exterior doors, where applicable.
 - d. Energy Star qualified exterior doors, where required.
 - 2. Metal louvered bi-fold doors.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Approval Documentation: For each type of exterior hollow-metal door and frame assembly, as required by the Authority Having Jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Delivery, storage, and handling shall comply with manufacturer's requirements.
- B. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum ~~4-inch~~ high wood blocking. Provide minimum ~~1/4-inch~~ space between each stacked door to permit air circulation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide the products from a manufacturer approved by the Owner and Architect.
 1. Swing Doors: Metal doors as indicated on the Drawings.
 2. Frames: Metal or wood door frames, where indicated on the Drawings.
 3. Bi-Fold Doors: Metal bi-fold doors as indicated on the Drawings.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Where required by Code, provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and 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.
- C. Structural Performance: Provide exterior metal doors and frames capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of components and supports, or permanent damage to fasteners and anchors.
 1. Wind load pressures shall be computed and applied using the design wind speed indicated by Wind Information located on Drawings.
 2. Exterior doors assemblies to comply with state or local missile impact resistance if required by the authorities having jurisdiction or as indicated on Drawings.
- D. Glazing in doors to comply with Safety Glazing materials as required by the Building Code.

2.3 DOORS AND FRAMES

- A. Construct doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Swing Doors and Frames: At locations indicated in the Door Schedule on Drawings.
 1. Hollow Metal Swing Doors:
 - a. Type: As indicated in the Door Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Steel sheet, Level-2, Heavy Duty, minimum thickness of 0.042 inch (**18 gauge**), or as required to meet fire rating requirements.
 - d. Edge Construction: Top and bottom rail constructed from wood. Stiles of continuous roll-formed steel.
 - e. Core: Polyurethane. All exterior doors to be insulated.
 - f. Acoustical rating: STC 22 or better.
 2. Metal Frames, where indicated:
 - a. Materials: Steel frame, minimum thickness of 16 gauge, or as required to meet fire rating requirements.
 - b. Construction: Adjustable (2) piece steel frame, or as required to meet fire rating requirements.
 3. Wood Frames, where indicated:

- a. Materials: Wood frame, manufacturer's standard product for exterior doors with wood composite bottom portion of frame to prevent rot, decay, and insect damage.
 - 4. Exposed Finish: Factory primed per manufacturer's standards. Field painted per Division 09 Section "Painting".
 - 5. Door Hardware: Provide hardware per Door Schedule on Drawings and Division 08, Section "Door Hardware".
 - 6. Threshold: Aluminum threshold to be accessible where required per applicable accessibility requirements.
 - 7. Fire-rated Assemblies: Provide labeled fire-rated assemblies where indicated on the Drawings.
 - 8. Smoke- and Draft-Control Assemblies: Where required by Code, provide labeled smoke and draft control assemblies.
 - 9. Energy Star: If required, provide exterior doors qualified to comply with Energy Star for project location.
- C. Interior Bi-fold doors:
- 1. Interior Bi-fold Doors: Metal louvered bi-fold door where indicated on Drawings, 24 gage formed panels, 1 inch thick with stiffener braces at top, center, and bottom. Steel shall be smooth finish, prefinished with manufacturer's standard baked-on synthetic enamel paint. Provide manufacturer's standard top and bottom tracks and door hardware.

2.4 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. 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. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
 - 3. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

2.5 STEEL FINISHES

- A. Factory Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for

substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

- B. Field Painted Finish: Paint as specified per Division 09 Section "Painting".

2.6 ACCESSORIES

- A. Louvers: Provide louvers for doors, where indicated and as specified on Drawings.

- 1. 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 qualified testing and inspecting agency that established fire-resistance rating of door assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-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 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 plumb, square, 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 will be filled with grout containing anti-freezing agents.
 2. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 3. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus $1/16$ inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus $1/16$ inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus $1/16$ inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus $1/16$ inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: $1/8$ inch plus or minus $1/32$ inch.
 - b. Between Edges of Pairs of Doors: $1/8$ inch to $1/4$ inch plus or minus $1/32$ inch.
 - c. At Bottom of Door: $3/4$ inch plus or minus $1/32$ inch.
 - d. Between Door Face and Stop: $1/16$ inch to $1/8$ inch plus or minus $1/32$ inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

- D. Glazing: Comply with installation requirements per the hollow-metal manufacturer's written instructions.

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. 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.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081420 - WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior solid core wood doors.
 - 2. Interior hollow core wood doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of construction.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain wood doors through one source from a single manufacturer.
- B. Quality Standard for Doors of Stock Design and Construction: Comply with WDMA I.S.1-A, "Architectural Wood Flush Doors," AWI, "Architectural Woodwork Quality Standards", and WI "Manual of Millwork", unless more stringent requirements are specified.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10B.
- D. Smoke- and Draft-Control Assemblies: Where required by Code, provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.
- C. Mark each door on top and bottom edge with opening number used on Shop Drawings.
- D. Environmental Limitations: Do not deliver or install doors 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.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the products from a manufacturer approved by the Owner and Architect.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Use only materials that comply with referenced quality standards unless more stringent requirements are specified.
- B. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - 3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- D. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

E. Hollow-Core Interior Wood Doors:

1. Molded panel doors fabricated using molded wood fiber facing, wood or MDF stiles, wood or MDF rails, and corrugated cell core.
2. Door facing to be bonded to stiles, rails, and core forming a 3-ply structural attachment.
3. Factory applied water based latex primer on door facings, stiles, and rails.
4. Mounting surface for latching hardware to be reinforced with solid internal support.
5. Hinge preparations for door thickness and height, as indicated on Drawings, to be as recommended by door manufacturer.
6. Face bore(s) for cylindrical lock and deadbolts, as indicated on Drawings, to be as recommended by door manufacturer.

G. Interior Door Frames:

1. Wood jambs fabricated as a flat jamb with doorstop applied or 2-piece split jamb.
 - a. Provide fire-rated metal door frames where required for fire-rated openings.
2. Hinge preparations for door frame shall be as recommended by the manufacturer for door thickness and height.
3. Strike jamb preparations to be machined for full lip cylindrical strike plate.

F. Glazing:

1. Glazing in doors to comply with Safety Glazing materials as required by the Building Code.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH (if required by Interior Designer)

A. Interior Solid-Core or Hollow-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Cherry.
3. Construction: Manufacturer's standard construction.
4. Style: As indicated on the Drawings.

2.4 DOORS FOR OPAQUE FINISH (as indicated by Interior Designer)

A. Interior Solid-Core or Hollow-Core Doors:

1. Grade: Custom.
2. Faces: Hardboard or MDF.
3. Construction: Manufacturer's standard construction.
4. Style: As indicated on the Drawings.

2.5 FABRICATION

- A. Fabricate wood doors and frames in sizes indicated on Drawings.
- B. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- C. Comply with requirements in NFPA 80 for fire-rated doors.
- D. Factory machine doors for hardware that is not surface applied to comply with final hardware schedules, door frame Shop Drawings, DHI A115-W Series standards, and hardware templates.
 - 1. Light Openings: Trim openings with manufacturer's standard.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished.
 - 3. Louvers: Factory install louvers in prepared openings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and substrates, with Installer present, for suitable conditions where wood doors will be installed.
 - 1. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Install wood doors to comply with manufacturer's written instructions and with referenced quality standard, and as indicated.
- C. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING AND PROTECTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081420

SECTION 083113 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes access doors and frames for walls and ceilings.

1.3 INFORMATIONAL 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.

1.4 QUALITY ASSURANCE

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to 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.

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.

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. Steel Sheet: 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.

- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating.
- D. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Unless indicated otherwise, provide one of the following as selected by Architect as appropriate for location conditions indicated:
 - 1. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating. Provide type of primer as required by Division 09 Section "Painting" for compatibility with field finish material.
- E. Drywall Beads: 0.0299-inch zinc-coated steel sheet to receive joint compound.
- F. Plaster Beads: 0.0299-inch zinc-coated steel sheet with flange of expanded metal lath.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by manufacturers that may be incorporated into the Work.
- B. Select door and frame types from the following for indicated details or required conditions.
- C. Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
 - 1. Locations: Wall and ceiling surfaces. At exterior locations, provide weatherproof type with extruded door gasket.
 - 2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
 - 3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
 - 4. Hinges: Continuous piano.
 - 5. Lock: [Cylinder type](#).
- D. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
 - 1. Locations: Wall and ceiling.
 - 2. Door: Minimum 0.060-inch thick sheet metal.
 - 3. Frame: Minimum 0.060-inch thick sheet metal with 1-1/4-inch wide, surface-mounted trim.
 - 4. Hinges: Continuous piano.
 - 5. Lock: [Cylinder type](#).
- E. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Fire-Resistance Rating: Not less than that indicated.
 - 3. Temperature Rise Rating: 250 deg F 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.
5. Frame: Minimum 0.060-inchthick sheet metal with drywall or plaster bead.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Lock: Self-latching device with [cylinder type lock](#).

2.3 FABRICATION

- A. Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.
- 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.
- 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. For frames set into masonry walls with anchors, 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.
- D. Paint to match wall or ceiling.

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 083113

SECTION 083200 - SLIDING GLASS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes sliding glass doors for exterior locations.
- B. Provide sliding glass doors, aluminum-framed or vinyl-framed as indicated on the Drawings, complying with the following:
 - 1. Impact-Resistant, laminated tempered glass.
 - 2. Insulated, Low-E glass.
 - 3. Energy Star Rated.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide sliding glass doors capable of complying with performance requirements indicated, based on testing manufacturer's sliding doors that are representative of those specified, and that are of minimum test size indicated below:
 - 1. Meets or exceeds AAMA/WDMA 101/I.S.2/A440 Ratings: SD-R50, WDMA Hallmark Certified.
- B. Structural Performance: Provide exterior sliding glass doors and frames capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Design Wind Loads: Design wind loads shall be as indicated on Drawings. Sliding doors to comply with design pressure as indicated on Drawings and as required by the authority having jurisdiction.
- C. Windborne-Debris Resistance, (where required): Provide sliding glass doors capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.
- D. Energy Star Qualified, (where required): Provide sliding glass doors that comply with current Energy Star Guidelines for the applicable product criteria and climate zone indicated.
- E. Forced-Entry Resistance: ASTM F 842, Minimum Security Grade: 10.

- F. Product Approval: Provide sliding glass doors that have been approved by the authorities having jurisdiction based on requirements for product approval for the conditions indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sliding glass doors.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work, operational clearances, and installation details.
- C. Product Schedule: Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of sliding glass door.
- B. Product Approval: Product Approval documentation for each sliding door type indicated, as required by the authority having jurisdiction.
- C. Maintenance Data: For sliding doors, operating hardware, weather stripping and finishes which shall be included in maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed sliding glass door installations similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain sliding glass doors through one source from a single manufacturer.
- C. Sliding Glass Door Standard: Comply with provisions in AAMA/NWWDA 101/I.S.2 for standards of performance, materials, components, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA-certified, sliding glass doors with an attached label.
- D. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
 - 1. Subject to compliance with requirements, permanently mark safety glass with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

- E. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
- F. Mockups: Build mockups to verify selections made and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for type(s) of sliding glass door(s) indicated, in the location(s) shown on Drawings.
- G. Pre-installation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify sliding glass door openings 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 opening dimensions and proceed with fabricating sliding glass doors without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sliding glass doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
 - e. Failure of insulating glass, if applicable to project.
 - 2. Warranty Period:
 - a. Sliding Door: 10 years from date of Substantial Completion.
 - b. Glazing: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the products from a manufacturer approved by the Owner and Architect.
 - 1. Sliding glass door units: Provided by same manufacturer as the windows for the project as approved by the Owner and Architect.

2.2 MATERIALS

- A. Sliding door manufacturer's standard materials for the sliding glass doors, aluminum-framed or vinyl-framed as indicated on the Drawings, with the following requirements:
 - 1. Impact-Resistant.
 - 2. Energy Star Rated.
 - 3. Air Leakage of ≤ 0.3 cfm/ft².
 - 4. Egress Opening: Sliding Glass Doors for dwelling units required to comply with Fair Housing shall have a 32 inch nominal clear opening (a clear opening from 31-5/8 to 32 inches or more).
 - a. Provide sliding glass doors in width required per manufacturer to comply with egress opening requirements.

2.3 GLAZING

- A. Glazing System: Provide manufacturer's standard glazing system that produces weathertight seal.
 - 1. Impact-Resistant, laminated glass.
 - 2. Tempered Safety Glass: ASTM C 1048.
 - 3. Insulated Low-E glass.
 - 4. Energy Star Rated:
 - a. Glass with solar heat gain coefficient (SHGC) of ≤ 0.25 , (for Southern or South-Central climate zones)
 - b. U-Factor of ≤ 0.30 .

2.4 HARDWARE

- A. General: Provide manufacturer's standard hardware compatible with frame material; designed to smoothly operate, tightly close, and securely lock sliding door, and sized to accommodate operable door panel weight and dimensions.

2.5 INSECT SCREENS

- A. General: Sliding door manufacturer's standard insect screen for the sliding door specified.

2.6 FABRICATION

- A. General: Fabricate sliding glass doors in sizes indicated per manufacturer's standards. Include a complete system for assembling components and anchoring of the sliding doors.

2.7 FINISHES

- A. Finish: Manufacturer's standard finish.

1. Color: Match windows.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather-tight sliding door installation.
 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within **3 inches** of opening.
 3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing sliding doors, hardware, accessories, and other components.
- B. Install sliding doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
 1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.
- C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weather-tight construction.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Clean surfaces immediately after installing sliding glass doors. Avoid damaging protective coatings and finishes. Remove excess glazing and sealants, dirt, and other substances.

- C. Clean glass of factory-glazed doors immediately after installing sliding glass doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels from glass surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the Construction Period.
- E. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written recommendations.
- F. Protect sliding glass doors from damage or deterioration until time of Substantial Completion.

END OF SECTION 083200

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes:
 - 1. Electrically operated sectional overhead doors.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - a. Basic wind speed, Importance factor and Exposure category as indicated on Drawings.
 - 2. Air Infiltration: Maximum Rate: **0.08 cfm at 15 mph.**
 - 3. Impact Test for Flying Debris (where applicable): Comply with ASTM E 1996, tested according to ASTM E 1886.
- B. Operation-Cycle Requirements: Provide sectional overhead door components and operators capable of operating for not less than 10,000 cycles.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional overhead door and accessory. Include the following:
 - 1. Summary of forces and loads on walls and jambs designed to support door and imposed load, unless design calculations have already been determined.
 - 2. Motors: Show nameplate data and ratings, characteristics, and mounting arrangements.
- B. Product Approval documentation as required by the Authority Having Jurisdiction.

1.05 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 sectional overhead doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from sectional overhead door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- D. Regulatory Requirements: Provide only products that have a current Building Product Approval Number as required by the Authority Having Jurisdiction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by manufacturers that may be incorporated into the Work which are acceptable to the Owner and Architect.
 - 1. Sectional Overhead Doors: Steel, non-insulated, panels as indicated on the Drawings or directed by the Owner.

2.02 SECTIONAL OVERHEAD DOOR

- A. Construct door sections including face sheets and frames from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Minimum Base-Metal Thickness for Section Faces (Uncoated; before galvanized coat is applied): 24 gauge.
 - 2. Exterior-Section Face: As indicated on the Drawings.
- B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high and nominally 2 inches deep. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
- C. Enclose open sections with channel end stiles formed from not less than 0.064-inch thick galvanized steel sheet and weld end stiles to door section in place. Provide intermediate stiles formed from not less than 0.064-inch thick galvanized steel sheet, cut to door section profile, and welded in place.
 - 1. Stile Spacing: Not more than 48 inches apart.

- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.
- E. Provide reinforcement for hardware attachment.
- F. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.
- G. Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants.
 - a. Pretreat zinc-coated steel, after cleaning, with a conversion coating of type suited to organic coating applied over it.
 - 2. Apply manufacturer's standard primer to both door faces after forming, according to coating manufacturer's written instructions for application and minimum dry film thickness. Provide primer that is compatible with finish coats specified in Section 09 90 00.

2.03 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced at 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.
 - 1. Provide tracks configured for standard lift types, unless required otherwise.
- B. Track Reinforcement and Supports: Galvanized steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
 - 1. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.
 - a. Repair galvanized coating on tracks according to ASTM A 780.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of overhead door.
 - 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.

2. Provide continuous flexible seals at door jambs for a weathertight installation.

2.04 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty galvanized steel hinges of not less than 0.0747-inch thick, uncoated steel at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch diameter roller tires for 3-inch wide track and 2-inch diameter roller tires for 2-inch wide track.
- D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
- E. 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 and outside.
 2. Lock cylinder is specified in Division 08 Section "Door Hardware."
- F. Chain Lock Keeper: Suitable for padlock.
- G. When door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.05 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from oil-tempered-steel wire complying with ASTM A 229/A 229M, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for a minimum of 10,000 cycles.
- B. Cable Drums: Cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either cable breaks.

- D. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level shaft and prevent sag.
- E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.06 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door 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: Hand-operated disconnect device 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 device 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. 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 or keypad operated.
- F. Door-Operator Type: Unit consisting of electric motor and the following:
 - 1. Provide operator type as recommended or required by manufacturer for specified door and installation conditions indicated.
- G. Electric Motors: 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 and not more than 1 fps, without exceeding nameplate ratings or service factor.
 - 1. Type and Service Factor: As required by Project conditions.
 - 2. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
- H. Obstruction Detection Device: Provide each motorized door with external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

- I. Limit Switches: Adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- J. Radio Control: Radio control system consisting of the following:
 - 1. Three-channel, universal coaxial receiver to open, close, and stop door.
 - 2. Two radio controls per operator.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install door, track, and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. Fasten vertical track assembly to framing, spaced not less than 24 inches apart. Hang horizontal track from structural overhead framing with angle or channel hangers fastened to framing by welding or bolting or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.02 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and with weathertight fit around entire perimeter.
- B. Touch-up Painting: Immediately after welding galvanized track to track supports, clean field welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Exterior storefront framing.
 - 2. Exterior manual-swing entrance doors and door-frame units.
 - 3. Storefront and Entrance Door Glass:

1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Provide Product Approval documentation as required by the Authority Having Jurisdiction.
- B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples: For each exposed finish required.
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.
- E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.
- B. Product test reports.
- C. Field quality-control reports.
- D. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. 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 change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- D. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

1.8 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of aluminum-framed entrances and storefronts 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure 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.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Structural: Test according to ASTM E 330.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration.
- F. Water Penetration under Static Pressure: Test according to ASTM E 331.

- G. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Energy performance shall meet or exceed the Energy Code requirements and calculations for the project. Refer to Energy Calculations for minimum requirements.
- H. Windborne-Debris Impact Resistance (where required): Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 as indicated in the State Building Code and as required by the Authority Having Jurisdiction.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers that may be incorporated into the Work acceptable to the Owner and subject to the Architect's review.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Manufacturer's standard construction.
 - 2. Glazing System: Manufacturer's standard, as indicated on Drawings.
 - 3. Finish: Selected by Owner from manufacturer's standard selection.
 - 4. Fabrication Method: Manufacturer's standard method.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: Manufacturer's standard extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: As indicated.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide non-removable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

- A. General: Provide compatible entrance door hardware and entrance door hardware sets indicated in door schedule as indicated on Drawings for each entrance door to comply with requirements in this Section.
 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- B. Pivot Hinges: BHMA A156.4, Grade 1.
 1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.
- C. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- D. Manual Flush Bolts: BHMA A156.16, Grade 1.
- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- F. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- G. Cylinders: BHMA A156.5, Grade 1.
 1. Keying: Master key system.
- H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- I. Operating Trim: BHMA A156.6.

- J. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- K. Concealed Overhead Holders: BHMA A156.8, Grade 1.
- L. Surface-Mounted Holders: BHMA A156.16, Grade 1.
- M. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- N. Weather Stripping: Manufacturer's standard replaceable components.
- O. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- P. Silencers: BHMA A156.16, Grade 1.
- Q. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of **1/2 inch**.
- R. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.6 GLAZING

- A. Glazing: Manufacturer's standard glazing to comply with Project requirements and wind load as indicated below or on the Drawings and the requirements by the State Building Code and the Authority Having Jurisdiction.
 - 1. Storefront and Entrance Door Glass Type: Double-pane insulated glass.
 - a. Impact Resistant, (where required); Large Missile Impact.
 - b. Tempered Glass, (where required).
 - c. Energy Star Rated, (if required by the Owner).
- 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.

2.7 FABRICATION

- A. Manufacturer's standard fabrication method.

2.8 ALUMINUM FINISHES

- A. Manufacturer's standard anodized or painted finish, as selected by the Architect, Interior Designer, or Owner.

PART 3 - EXECUTION

3.1 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 non-movement 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 perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

1. Provide sealed End Dam at each end of sill assembly installed by manufacturer or otherwise installed by contractor per manufacturer's requirements.

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.

F. Install glazing per manufacturer's requirements.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas shall be tested according to AAMA 503 and shall not show evidence of water penetration.
 - a. Cyclic pressure test method shall be used.
 - b. Recommend testing to be done at mock-up or the first windows installed and then at 5% and 50% for a total of 3 rounds of testing at location designated by the Architect.
- B. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 085313 - VINYL WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Vinyl (PVC) window units, as indicated on the Drawings.
 - a. Window types, as indicated on the Drawings.
 - b. Frame as required for construction indicated per the Drawings.
 - c. Impact rated.
 - d. Energy Star qualified.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size required by AAMA/WDMA/CSA 101/I.S.2/A440, NAFS:
 - 1. Performance Class (PC): R – Residential, or better.
 - 2. Performance Grade (PG): Equal to, or greater than, the Project design pressure. Design pressure to be as indicated on Drawings and as required by the Authority Having Jurisdiction.
 - 3. Resistance to Water Penetration: ASTM E 547, water resistance test pressure to be 15% of the design pressure but not less than 2.9 lbf/sq. ft. (140 Pa).
 - 4. Resistance to Air Infiltration: ASTM E 283, less than 0.3 cfm/sq. ft.
- B. Structural Performance: Provide windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA/CSA 101/I.S.2/A440, NAFS, Uniform Load Structural Test.
 - 1. Design Wind Loads: Design wind loads shall be as indicated on Drawings and as required by the Authority Having Jurisdiction.
- C. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of Authorities Having Jurisdiction.

- D. Product Approval: Provide windows that have been approved by the Authorities Having Jurisdiction based on requirements for product approval for the conditions indicated.
- E. Operable Windows: Where required by Code, provide window with window opening control devices compliant with ASTM F 2090 where the opening of the sill portion is more than 72 inches above the finished grade and less than 36 inches above the finished floor surface.
 - 1. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Code for Emergency Escape and Rescue.
- F. Energy Star Qualified: Provide windows that comply with current Energy Star Guidelines for the applicable product criteria and climate zone indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and related items.
- C. Product Approval Documentation: Include product approval documentation indicating the windows are approved by the Authorities Having Jurisdiction as required.
- D. Product Schedule: Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of window. Test results based on use of downsized test units will not be accepted.
- B. Maintenance Data: For operable window, sash operating hardware, weather stripping and finishes to include in maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

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

- C. Source Limitations: Obtain windows through one source from a single manufacturer.
- D. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440, NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA-certified windows with an attached label.
- E. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
- F. Mockups: Build mockups to verify selections made and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for type(s) of window(s) indicated.
- G. Pre-installation Conference: Conduct conference at Project site. Review methods and procedures related to windows 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. Review, discuss, and coordinate the interrelationship of windows with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
 - 3. Review and discuss the sequence of work required to construct a watertight and weather-tight exterior building envelope.
 - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify window openings 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 opening dimensions and proceed with fabricating windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace windows that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.

- b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
- c. Faulty operation of movable sash and hardware.
- d. Deterioration of materials, and finishes beyond normal weathering.
- e. Failure of insulating glass.

2. Warranty Period: **10** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the products from a manufacturer approved by the Owner and Architect.

2.2 MATERIALS

- A. Window Type: As indicated on Drawings.
 - 1. Frame material: Vinyl.

2.3 GLAZING

- A. Glazing System: Manufacturer's standard factory-glazing system that produces weather-tight seal and complies with requirements for the project.
 - 1. Type: Double-pane insulated glass.
 - 2. Impact rated.
 - 3. Energy Star qualified.

2.4 HARDWARE

- A. General: Provide manufacturer's standard hardware compatible with vinyl; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash or ventilator weight and dimensions.
 - 1. Window opening control device, where required per Code.

2.5 INSECT SCREENS

- A. General: Window manufacturer's standard insect screen for the windows specified.

2.6 ACCESSORIES

- A. Dividers (False Muntins): Provide manufacturer's standard dividers in designs indicated for each sash lite.

2.7 FABRICATION

- A. General: Window manufacturer's standard fabrication for windows in sizes indicated.

2.8 VINYL FINISHES

- A. Integral Finish and Color: Uniform, solid, homogeneous interior and exterior.
 - 1. Color: As selected by Owner or Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather-tight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
 - 1. Wood Frame Construction Installation: For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112 and FMA/AAMA 100-12.
 - 2. Masonry Construction Installation: For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in FMA/AAMA 200-12 and FMA/WDMA 250-10.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
 - 1. Anchor window as required to comply with the Product Approval documentation and the Authority Having Jurisdiction requirements for the window being installed.
- C. Set in bed of sealant or with gaskets for weathertight construction, as indicated on Drawings and as recommended by the window manufacturer.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas shall be tested according to AAMA 502 and shall not show evidence of water penetration.
 - a. Cyclic pressure test method shall be used.
 - b. Recommend testing to be done at mock-up or the first windows installed and then at 5% and 50% for a total of 3 rounds of testing at location designated by the Architect.
 - 2. Test Reports: Prepared according to AAMA 502.
- C. Windows will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather-tight closure. Lubricate hardware and moving parts.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 085313

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - b. Folding doors.
 - c. Sliding doors.
 - 2. Electrified door hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's catalog cut sheets, construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Other Action Submittals:
 - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

1.4 CLOSEOUT SUBMITTALS – TO OWNER

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI.
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1, HUD's "Fair Housing Accessibility Guidelines", and Uniform Federal Accessibility Standards (UFAS), where applicable.
- I. Preinstallation Conference: Conduct conference at Project site.

1.6 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Two years from date of Substantial Completion.
 - c. Manual Closers: Ten years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide door hardware for each door as scheduled in Door Hardware Schedule on Drawings to comply with requirements in this Section.
- B. Hardware shall be ANSI/BHMA Certified.
- C. The Hardware Supplier shall furnish all necessary screws, bolts, shields and other devices required for the proper fastening and operation of the hardware, whether or not specifically mentioned herein or on the Drawings and these items shall harmonize with the hardware as to material and finish. Omissions and/or discrepancies shall be brought to the Architect's attention during the bidding period.
- D. Provide matching finishes for hardware at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and texture as much as possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match

items to the manufacturer's standard finish for the latch and lockset (or push/pull units if no latch/lock sets) for color and texture.

- E. Hardware Finish: All door hardware to be finished as specified by the Owner or the Interior Designer.

2.2 LOCKSETS, LATCHSETS, AND DEADBOLTS

A. Locksets, Latchsets, and Deadbolts:

1. Products: Subject to compliance with the following requirements, provide products indicated on the Drawings or as specified by the Owner or Interior Designer.
 - a. Dwelling Unit and Common Entry Doors: ANSI/BHMA Grade 2 minimum.
 - b. Dwelling Unit Interior Doors: ANSI/BHMA Grade 3 minimum.
 - c. Common Area Interior Doors: ANSI/BHMA Grade 2 minimum.
 - d. Style: All doors to have "Lever Style" handles. Style design to be specified by the Owner or the Interior Designer, compliant with applicable accessibility requirements where required.

2.3 HINGES, BOLTS, STOPS, SWEEPS, & MISC.

A. Hinges, Head & Foot Bolts, Door Stops, Bottom Sweeps, Door Knocker/Viewer, Door Seals, Silencers, Weather Stripping, Roller Latches, and other related hardware.

1. Hinges: BHMA A156.1.
2. Door Stops: Provide appropriate type of door stop for door type and location.
 - a. Mounting: Do not install door stops on door. Mounting shall be to baseboard, floor, or wall as indicated on Drawings or as otherwise required for proper function.
 - b. Hinge Pin Door Stops: Shall only be used on lightweight hollow-core doors where other standard type door stops, (baseboard stops, floor mounted stops, or wall bumper stops) cannot be used. Where hinge pin door stops must be used, provide DoorSaver type or comparable.
3. Spring Hinges: BHMA A156.17.
 - a. Closing Speed: Door spring hinges for doors on an accessible route shall be adjusted so that from an open position of 70 degrees, the door shall move to the closed position in 1.5 seconds minimum, per ICC/ANSI A117.1.

2.4 EXIT DEVICES AND CLOSERS

A. Exit Devices, Closers, and other related hardware.

1. Exit Devices: BHMA A156.3, Grade 1.

- a. Fire Exit Hardware; where required, tested per UL 10C, bearing two labels-one for panic and one for fire.
 - b. Panic Hardware; where required, tested per UL 305.
- 2. Door Closers: BHMA A156.4.
 - a. Door Closers Closing Speed: Door closers for doors on an accessible route shall be adjusted so that from an open position of 90 degrees, the time required to move the door to an open position of 12 degrees shall be 5 seconds minimum, per ICC/ANSI A117.1.
 - b. Door closers for UFAS Dwelling Units shall be adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door, per UFAS.

2.5 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Accessible door thresholds: Provide thresholds that comply with applicable accessibility requirements where required.

2.6 ELECTROMAGNETIC STOPS AND HOLDERS

- A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.

2.7 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

2.8 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. Keying for Project to be as follows or as otherwise specified or approved by the Owner:
 - a. All locks shall be mastered keyed. Provide 5 keys to Owner, or as otherwise specified by the Owner, and 1 key in each Knox- box.
 - b. Three keys shall be furnished for each lock.
 - c. All locks in same unit shall be keyed alike.

- d. Keys shall be tagged with unit numbers and delivered to apartment management in key cabinet properly indexed.
- e. Owner to specify keying of locks in Clubhouse and other Amenity Areas.

2.9 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock. Sized as required to accommodate all project keys.
- B. Key Lock Boxes: Locate key lock boxes, (1) per building, location as directed by the Authority Having Jurisdiction. Install with (1) master key each.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying schedule or as directed by Owner.
- F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide appropriate type of door stop for door type and location. Do not mount floor stops where they will impede traffic.
- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Upon completion, and as a condition of its acceptance, verify proper appearance and operation of all finish hardware under this Section and place in optimum working condition.
- B. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching and provide required minimum closing speed as specified.
 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- C. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

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

END OF SECTION 087100

SECTION 088300 – MIRRORS

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. Annealed monolithic glass mirrors.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Data: For mirror, hardware, and mastic.
- B. Product Certificates: For each type of mirror and mirror mastic, signed by product manufacturer.

1.4 QUALITY ASSURANCE

- A. Glazing Publications: Comply with GANA's "Glazing Manual" and GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors" unless more stringent requirements are indicated

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated in second subparagraph below.
 - 1. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's

written instructions. Defects include discoloration, black spots, and clouding of the silver film.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRROR MATERIALS

- A. General: Provide mirrors in locations indicated on Drawings or as specified by Interior Designer or otherwise directed by Owner. Mirror type, size, and style shall be as indicated by Interior Designer or as directed by Owner.
 1. Edges to be polished or framed, as directed, ensuring no sharp edges.
 2. Mirrors to be securely mounted.
 3. Mirrors to be free from silver oxidation.
- B. Clear Glass Mirrors: ASTM C 1503, Mirror Glazing Quality.
 1. Nominal Thickness: 1/4 inch.

2.2 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.3 MIRROR HARDWARE

- A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
- B. Mirror Bottom Clips: As indicated.
- C. Mirror Top Clips: As indicated.
- D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- E. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

- A. Mirror Sizes: To suit Project conditions and as indicated on Drawings. Cut mirrors to final sizes and shapes.
- B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Rounded polished edge.
 - 1. Seal edges of mirrors after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of **1/8 inch** between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. For wall-mounted mirrors, install with mastic and mirror hardware.
 - 1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 2. For mirror hardware in the form of continuous J-channels at bottom, provide setting blocks **1/8 inch** thick by **4 inches** long at quarter points. To prevent trapping water, provide, between setting blocks, 2 slotted weeps not less than **1/4 inch** wide by **3/8 inch** long.
 - 3. For mirror hardware in the form of a continuous J-channel at bottom and continuous top trim at top, fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
 - 4. For metal or plastic clips, place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges.
 - 5. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of **1/8 inch** between back of mirrors and mounting surface.

3.2 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 092216 - NON-STRUCTURAL METAL FRAMING – CEILING CLIP SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient sound isolation system with clips, sealant, and drywall furring channels for support of gypsum board for noise control (decoupling) in ceilings.
 - a. Install system where indicated on Drawings.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit product data, including manufacturer's guide specifications product sheet, for specified products.
- B. Shop Drawings: Manufacturer's specifications, catalog cuts, and other items needed to demonstrate compliance with the specified requirements. Also the manufacturer's recommended installation procedures, which, when approved by the architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Conform to UL Fire Resistance Directory design assemblies, where required.

2.2 RESILIENT SOUND ISOLATION SYSTEM

- A. Manufacturer: Pliteq Inc.
- B. Products:
 - 1. Pliteq GenieClip Resilient Sound Isolation Clip.

- a. The molded rubber and steel resilient sound isolation clip furnished under this specification shall be Pliteq GenieClip Resilient Sound Isolation Clip.
 - b. Rubber Isolator: Compressible elastomer, low durometer compound, unibody design.
 - c. Manufactured to ASTM D2000.
 - d. Laboratory tested to ASTM D5992, ASTM D4473, and ASTM D4065.
 - e. Clip: Galvanized steel with 90 micron aluminum-zinc coating.
2. Pliteq GenieClip ACS Acoustical Sealant.
- a. GenieClip ACS is a single-component, non-skinning, non-hardening synthetic rubber sealant.
3. Drywall Furring Channels (Hat Channel).
- a. Cold-formed galvanized steel.
 - b. Conformance: AISI Specifications for Design of Cold-Formed Steel Structural Members, ASTM C645, ASTM C754.
 - c. Designation: Steel Stud Manufacturers Association (SSMA) Code 087F125-18 (25 gauge), 7/8 inch height, between 2-1/2 and 2-11/16 inches width.
4. Mechanical Fasteners.
- a. Type: Self-drilling, self-tapping screws. Steel, ASTM C1002. Galvanized coating, plated, or oil-phosphate coated, ASTM B633, as needed for required corrosion resistance.
 - b. To Wood Framing Members: Screws 2-1/2 inches (63 mm) minimum length, #8 minimum shank, Type W (course thread), bugle- or hex-head screws of equal or greater size.
 - c. Drywall Furring Channel Lap Joint Connection, Steel to Steel: Framing screws, button head, 7/16 inch (11 mm) minimum length, #6 minimum shank, needle point, Phillips drive or greater, or double-wire tie with 18 gauge tie wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.2 INSTALLATION - CEILINGS

- A. Install GenieClip, sealant, and drywall furring channels in accordance with manufacturer's written instructions and requirements.
- B. Fire-Resistive Design Assemblies:
 - 1. Install as specified in UL Fire Resistance Directory, where required.
- C. Ensure rubber isolator of GenieClip is in firm contact with structural member.
- D. Locate GenieClip maximum of 6 inches (150 mm) from ends of drywall furring channels.
- E. Locate drywall furring channels maximum of 3 inches (75 mm) from parallel wall assemblies.

3.3 CLEANING AND PROTECTION

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- B. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 092216

SECTION 092400 - PORTLAND CEMENT PLASTERING

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 portland cement plasterwork (stucco) on metal lath plaster bases.
 - a. Metal lath with paper backing.
 - b. Accessories.
 - c. Decorative moldings.
 - d. Cement plaster system.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's product datasheets for each type of product indicated.
- B. Installation Instructions: Manufacturer's installation instructions for fiber-reinforced or other proprietary systems.
- C. Evaluation Reports: For each type of product indicated.
- D. Product Approval: Documentation, if required by the Authority Having Jurisdiction.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For portland cement plaster assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to Authorities Having Jurisdiction.
- B. Mockups: Before plastering, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for each type of finish indicated.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements and manufacturer's recommendations.
- B. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 deg F.
 - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

PART 2 - PRODUCTS

2.1 METAL LATH

- A. Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
- B. Diamond-Mesh Lath: Self-furring, 2.5 lb/sq. yd. for vertical installation and 3.4 lb/sq. yd. for horizontal installation.
- C. Paper Backing: FS UU-B-790, Type 1 Grade D, ASTM D 779, 60 minute, Style 2 vapor-permeable and asphalt-saturated kraft paper (or) No. 15 felt, ASTM D 226, Type 1, non-perforated asphalt-saturated felt paper.
 - 1. Provide paper backing behind lath at exterior wood framed locations over weather resistive barrier, (building wrap), as specified in Division 07.
 - a. Provide and install separate paper backing with non-backed lath over weather resistive barrier, (building wrap).
 - b. Alternate: Provide and install paper-backed lath over weather resistive barrier, (building wrap).

2.2 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Plastic Trim: Fabricated from high-impact PVC.
 - 1. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - a. Square-edge style; use unless otherwise indicated.
 - b. Bull-nose style, radius 3/4 inch minimum; use at locations indicated on Drawings.
 - 2. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

3. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged **1/2-inch**- wide reveal; with perforated concealed flanges.
4. Foundation Weep Screeds: With perforated sloped flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.

2.3 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063 or with the manufacturer's specifications and independent testing agency evaluation report acceptable to authorities having jurisdiction for applications indicated.

2.4 DECORATIVE MOLDINGS

- A. Foam Moldings: Factory molded product of shapes as indicated on the Drawings, for exterior applications for stucco exterior finish. Product shall comply with stucco manufacturer's recommendations and installation requirements.
 1. Product: Expanded polystyrene, (EPS).
 2. Shapes: As indicated on Drawings.
 3. Stucco Mesh: Fiberglass mesh.
- B. Foam Plastic Molding: Molded product of shapes indicated, with a tough outer skin on exposed surfaces; factory primed. Exposed surfaces shall not be shaped after molding. Product is recommended by manufacturer for exterior use.

2.5 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
- C. Sand Aggregate: ASTM C 897.

2.6 PLASTER MIXES

- A. General: Comply with ASTM C 926 or with the manufacturer's specifications and independent testing agency evaluation report acceptable to authorities having jurisdiction for applications indicated.

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 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

3.3 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings or as otherwise required by the stucco manufacturer's specifications and independent testing agency evaluation report acceptable to authorities having jurisdiction for applications indicated.

3.4 INSTALLING METAL LATH

- A. Expanded-Metal Lath: Install according to ASTM C 1063 or with the stucco manufacturer's specifications and independent testing agency evaluation report acceptable to authorities having jurisdiction for applications indicated.

3.5 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings or with the manufacturer's independent testing agency evaluation report acceptable to authorities having jurisdiction for applications indicated.
- B. Control Joints: Install control joints at locations indicated on Drawings or in specific locations approved by Architect for visual effect as follows:
 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft..
 - b. Horizontal and other Non-vertical Surfaces: 100 sq. ft..
 2. At distances between control joints of not greater than 18 feet o.c.
 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 4. Where control joints occur in surface of construction directly behind plaster.
 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

- A. General: Comply with ASTM C 926 or with the manufacturer's specifications and independent testing agency evaluation report acceptable to authorities having jurisdiction for applications indicated and refer to Drawings for minimum thickness.

1. Do not deviate more than plus or minus **1/4 inch in 10 feet** from a true plane in finished plaster surfaces, as measured by a **10-foot** straightedge placed on surface.
 2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least **6 inches** at each jamb anchor.
 3. **Sufficient slope on faces of plaster surfaces shall be provided to prevent water from accumulating or standing.**
 4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Plaster Finish Coats: Apply to provide finish texture as indicated on Drawings or selected by the Owner and Architect.
- C. Curing of Plaster: Moist cure with a fog spray of clean water in sufficiently frequent applications to maintain stucco uniformly moist for proper hydration per manufacturer's specifications.

3.7 FOAM MOLDING INSTALLATION

- A. General: Preparation and installation of foam moldings, if required per the Drawings, shall comply with manufacturer's recommendations.
1. Before installing foam molding on wall, apply stucco scratch coat on foam and imbed fiberglass mesh. Return this treatment onto backside of foam molding.
 2. Install foam molding with imbedded mesh over stucco scratch coat on wall per manufacturer's installation recommendations.
 3. Apply final coat of stucco to foam molding and wall per manufacturer's recommendations.
 4. Paint as specified per Division 09.

3.8 CUTTING AND PATCHING

- A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum board for walls and ceilings.
 - 3. Tile backing panels.

1.3 ACTION 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.
- B. Regular Type:
 1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- C. Type X:
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- D. Type C:
 1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 2. Long Edges: Tapered.

2.3 EXTERIOR GYPSUM BOARD

- A. Exterior Gypsum Board (when indicated or required): ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.
 1. Core / Thickness: As indicated on Drawings.
- B. Glass-Mat Gypsum Sheathing Board (when indicated or required): ASTM C 1177/C 1177M.
 1. Core / Thickness: As indicated on Drawings.

2.4 MOISTURE-RESISTANT PANELS (NON-WET AREAS)

- A. Moisture-Resistant Gypsum Backing Board, (Greenboard), (Not for use in wet areas such as tile tub and shower surrounds): ASTM C 630/C 630M or ASTM C 1396/C 1396M.

1. Core / Thickness: As indicated on Drawings.
 2. Locations: Dwelling unit bathroom walls and Public restroom walls.
 - a. Walls with or without tile wall covering in non-wet areas.
 - b. Tub or shower surrounds with one-piece type acrylic or fiberglass enclosures.
 - c. Not for use in wet areas such as tile tub and shower surrounds.
 - d. Installed in accordance with GA-216 or ASTM C 840 and manufacturer recommendations.
- B. Regular Gypsum Wallboard: Permitted under tile or wall panels in other wall and ceiling areas when installed in accordance with GA-216 or ASTM C 840.

2.5 TILE BACKING PANELS (IN WET AREAS)

- A. General: One of the following products may be used for Tile backing panels in wet areas such as tub and shower surrounds.
- B. Glass-Mat, Water-Resistant Backing Board:
1. Complying with ASTM C 1178 / 1178M.
 2. Core / Thickness: As indicated on Drawings.
- C. Discrete Non-Asbestos Fiber-Cement Sheets:
1. Complying with ASTM C 1288.
 2. Core / Thickness: As indicated on Drawings.
- D. Non-Asbestos Fiber-mat Cementitious Backer Units:
1. Complying with ANSI A118.9 or ASTM C 1325.
 2. Core / Thickness: As indicated on Drawings.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.
 - f. Control Joint.
- B. Exterior Trim: ASTM C 1047.
1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
 2. Shapes:

- a. Cornerbead.
- b. LC-Bead: J-shaped; exposed long flange receives joint compound.
- c. Control Joint.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 3. 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, rounded or beveled panel edges, 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 where a Level 5 finish is required, use drying-type, all-purpose compound.
- D. Joint Compound for Exterior Applications:
 - 1. 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.

2.8 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.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

2.9 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Texture Finish: Water-based, job-mixed, non-aggregated, drying-type texture finish for spray application.
 1. Texture: Spatter knock-down, unless otherwise specified by the Interior Designer.

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. Control Joints: Install control joints to assist in relieving stresses in assemblies that can result in gypsum board joint cracks and ridging. Control joints to be installed per Gypsum Association and manufacturer's recommendations and minimum requirements. Fire-resistance rated systems to be installed as recommended by Gypsum Association GA-234.
 1. Gypsum board control joint locations are not shown on the Drawings, except where incorporated as a design accent or architectural feature. Proposed general control joint locations shall be determined by the Contractor and the Contractor shall have the Owner review and approve proposed locations prior to installation.

- C. 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.
- D. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch** of open space between panels. Do not force into place.
- E. 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.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft.** in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch-** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide **1/4- to 1/2-inch-** wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.
- J. 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. Regular Type: As indicated on Drawings.
 - 2. Type X: Where required for fire-resistance-rated assembly.
 - 3. Type C: Where required for specific fire-resistance-rated assembly indicated.
 - 4. 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 horizontally (perpendicular 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 ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, **16 inches** minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. 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.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

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** open space where panels abut other construction or structural penetrations.
 2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

- A. Tile Backing Panels: Install at showers, tubs, and where indicated. Install with **1/4-inch** gap where panels abut other construction or penetrations.

- B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- C. 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. 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. U-Bead: Use where indicated.
 - 5. Curved-Edge Cornerbead: Use at curved openings.
- C. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.

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, rounded or beveled edges, 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, typical unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.
 - 4. Level 5: Where directed by Interior Designer or Owner for surfaces required to have highest quality finish.

- E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and over-spray to prevent damage according to texture-finish manufacturer's written recommendations.

3.9 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.

END OF SECTION 092900

SECTION 093000 – TILING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer and coordinate with Interior Design Documents or as otherwise directed by Owner.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Glazed ceramic floor tile.
 - 2. Glazed ceramic wall tile and base trim.
 - 3. Stone thresholds.
 - 4. Impact sound control underlayment, (where required).

1.3 SUBMITTALS

- A. Product data: For each type of product specified.
- B. Samples: Submit to Interior Designer, or as otherwise directed by Owner, for selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type and composition of tile indicated. Include samples of grout and accessories involving color selection.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If despite these precautions coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
- C. Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.7 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
- B. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size.

PART 2 - PRODUCTS

2.1 GENERAL

- A. General: Refer to the Drawings and specifications by the Interior Designer or as otherwise directed by Owner for tile locations, specified manufacturer, and products to be used.
- B. Sound Control: The floor/ceiling assembly of upper level floors, including finished flooring materials, to have not less than the following ratings as required by the Building Code or as indicated on the Drawings:
 - 1. IIC rating: Not less than 50, or a FIIC rating of 45 (field tested rating).
 - 2. STC rating: Not less than 50, or a FSTC rating of 45 (field tested rating).

2.2 MATERIALS

- A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
- B. Slip resistance testing method to comply with the Dynamic Coefficient of Friction, (DCOF), testing and have a wet DCOF of 0.42 or greater.
- C. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.
- D. Tile Council of American (TCA) Standards: Products shall comply with recommendations in TCA's "Ceramic Tile: The Installation Handbook".
- E. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- F. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements.
- G. Provide selections made by Owner or Interior Designer from manufacturer's full range of standard colors, textures, and patterns for products of type indicated, or when not indicated, as will be selected at a later date.
- H. Factory Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.
- I. Accessories for Glazed Wall Tile: Provide vitreous china accessories of type and size indicated and in color and finish to match adjoining glazed wall tile. Where glazed wall tile is specified by the Architect or Interior Designer at tubs and showers, provide the following:
 - 1. One soap holder for each shower and tub indicated.
 - 2. One 18" towel bar for each shower and tub indicated.
- J. Provide trim items such as base coves, caps, external corners, internal corners, or other items as necessary or as specified by the Interior Designer to provide a complete and finished installation.

2.3 GROUTING MATERIALS

- A. Provide grout as approved by tile manufacturer for type of tile and location. Provide grout that complies with all requirements of ANSI Specifications and Tile Council of America product requirements.

2.4 ELASTOMERIC SEALANTS

- A. Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.

- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part Mildew Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.
- D. Chemical Resistant Sealants: For chemical resistant floors, provide sealants compatible with chemical-resistant mortars and grouts, approved for use indicated by manufacturers of both mortar/grout and sealant and with chemical-resistance properties equivalent to mortar/grout.

2.5 MISCELLANEOUS MATERIALS

- A. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile and mortar/grout products, and is easily removable after grouting is completed without damaging grout or tile.
 - 1. Petroleum paraffin wax, fully refined, tasteless, odorless, containing at least 0.5 percent oil with a melting point of 120 deg F (49 deg C) to 140 deg F (60 deg C) per ASTM D 87.
- B. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

2.6 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

2.7 STONE THRESHOLDS

- A. Provide stone thresholds, when scheduled or required, that are uniform in color and finish, fabricated to sizes and profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces, selected from optional materials listed below.
 - 1. When required, fabricate thresholds to heights indicated, but not more than 1/2 inch above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.
- B. Marble Thresholds: Provide marble items complying with recommendations and requirements of MIA and with a minimum abrasive-hardness value of 10 per ASTM C 241.
 - 1. Color, finish: Unless selected otherwise by the Owner or Interior Designer, provide White with honed finish.
 - 2. Size: 4 x 1/2 in. by full width of wall or frame opening, beveled both sides, radiused edges from bevel to vertical face.

2.8 IMPACT SOUND CONTROL UNDERLAYMENT

- A. General: Provide and install impact sound control underlayment where floor tile is specified for upper level floors separating tenants to provide the required sound control rating.
- B. Sound Control Rating: Provide and install impact sound control underlayment providing an IIC rating of 50 or better as required by the Building Code.
- C. Installation:
 - 1. For installation under the gypsum cement underlayment, see Impact Sound Control Underlayment as specified in Section 035413 Gypsum Cement Underlayment and per the specified fire rated floor/ceiling assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
- B. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
- C. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
- D. Verify that the installation of impact sound control underlayment has been installed in appropriate locations.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without

marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

- E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
- F. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
- G. Lay out tile wainscots to next full tile beyond dimensions indicated.
- H. Grout tile to comply with the requirements of the following installation standards:
 - I. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.
 - J. For chemical resistant epoxy grouts, comply with ANSI A108.6.
 - K. For chemical resistant furan grouts, comply with ANSI A108.8.

3.3 FLOOR INSTALLATION METHODS

- A. Ceramic Floor Tile: Install tile to comply with requirements indicated by the tile manufacturer for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types.

3.4 WALL TILE INSTALLATION METHODS

- A. Install types of tile designated for wall application to comply with requirements of the tile manufacturer for setting-bed methods, TCA installation methods related to subsurface wall conditions, and grout types.

3.5 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
- B. Remove latex portland cement grout residue from tile as soon as possible.
- C. Clean tile per manufacturer's written instructions.
- D. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer.
- E. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- F. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.

- G. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- H. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- I. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093000

SECTION 096000 - FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to and coordinate with Interior Design Documents, or as otherwise directed by Owner, for flooring requirements for all areas.

1.2 SUMMARY

- A. All flooring material shall be specified by the Owner, Interior Designer, or indicated on the Drawings and shall include, but not limited to, the following:
 - 1. Athletic flooring.
 - 2. Carpet.
 - 3. Luxury vinyl flooring, simulated wood.
 - 4. Sound control underlayment mat, where required.
- B. Impact sound control underlayment: For upper level floors separating tenants in locations indicated on Drawings to have hard surface flooring, provide impact sound control underlayment to provide an IIC rating of 50 or better as required by the Building Code.
 - 1. Sound control underlayment may be installed under or above the gypsum-cement underlayment. Coordinate with gypsum-cement underlayment contractor.
- C. Refer to Division 09 Section "Tiling" for tile floors.

1.3 SUBMITTALS

- A. General: Submittals to be provided to Interior Designer or as otherwise directed by the Owner.
- B. Product Data: Manufacturer's product data for each type of product indicated.
- C. Samples: Submit samples to Interior Designer, or as otherwise directed by Owner, in manufacturer's standard size, but not less than 12-by-12-inch sections of each different color and pattern of floor covering required.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by the flooring manufacturer for the installation of each type of product indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store flooring products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by the flooring manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor coverings.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 FLOORING PRODUCTS

- A. General: Products shall comply with low or no VOC limits as necessary to comply with requirements.
- B. Products: Subject to compliance with requirements, provide products as indicated on the Drawings or as specified by the Interior Designer or as otherwise directed by Owner.

2.2 IMPACT SOUND CONTROL UNDERLAYMENT

- A. General: Provide and install impact sound control underlayment where hard surface flooring is specified for upper level floors separating tenants to provide the required sound control rating.
- B. Sound Control Rating: Provide and install impact sound control underlayment providing an IIC rating of 50 or better as required by the Building Code.
- C. Installation:

1. For installation under the gypsum cement underlayment, see Impact Sound Control Underlayment as specified in Section 035413 Gypsum Cement Underlayment and per the specified fire rated floor/ceiling assembly.

2.3 INSTALLATION MATERIALS

- A. Provide all materials as required by the flooring material manufacturer that are applicable to the floor covering and substrate conditions as recommended by the manufacturer.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- C. Sealer for Gypsum Cement Underlayment: As recommended in writing by gypsum product manufacturer and flooring manufacturer.
- D. Adhesives: Water-resistant type and brand recommended by manufacturer to suit floor covering and substrate conditions indicated.
 1. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where flooring will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed flooring.
- B. Verify that substrates are firm, dry, clean, and free from oil or waxy films and curing compounds.
- C. Verify that the installation of impact sound control underlayment has been installed in appropriate locations.
- D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION / INSTALLATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
- B. Gypsum Cement Underlayment Substrates:
 1. Apply a latex sealer to all gypsum underlayment floor areas to receive vinyl flooring in strict compliance with sheet flooring material manufacturer's written instructions.
 2. Take additional precautions necessary to ensure proper adhesion and prevent discoloration of vinyl as a result of moisture or chemical incompatibility as recommended by gypsum topping and vinyl manufacturers.

C. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor coverings until they are same temperature as space where they are to be installed.

1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing flooring.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of flooring.
- B. Protect flooring until Substantial Completion.

END OF SECTION 096000

SECTION 097200 - WALL COVERINGS

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.
- B. Refer and coordinate with Interior Design Documents or as otherwise directed by Owner.

1.2 SUMMARY

- A. All wall covering material, if required, shall be specified by the Owner, Interior Designer, or indicated on the Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. General: All wall covering shall be submitted directly to the Interior Designer for review.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.
- D. Samples: As requested by the Interior Designer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.
- F. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.

1.5 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. Wall-Covering Materials: For each type, full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

- A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.2 MANUFACTURER

- A. Products: Subject to compliance with requirements, provide the products specified in each wall covering listed in the Interior Designer's Documents.

2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Primer/Sealer: Mildew resistant, complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by wall-covering manufacturer for intended substrate.
- C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.
- D. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- B. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.

2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 3. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 4. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 5. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- C. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
 - D. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
 - E. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.
 - F. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
 - G. Install strips in same order as cut from roll.
 - H. Install reversing every other strip.
 - I. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
 - J. Match pattern **72 inches (1830 mm)** above the finish floor.
 - K. Install seams vertical and plumb at least **6 inches (150 mm)** from outside corners and **3 inches (75 mm)** from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
 - L. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
 - M. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.
 - N. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
 - O. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099100 – PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer and coordinate with Interior Design Documents or as otherwise directed by Owner.

1.2 SUMMARY

- A. Provide painting for the Project that includes, but is not limited to the following:
 - 1. Field applied painting and finishing of exposed exterior and interior surfaces scheduled or indicated on Drawings and as otherwise specified.
 - 2. Surface preparation, if not prepared under other specifications sections.
 - 3. Factory Primed Products: Check all specification Sections to determine items furnished factory primed or prefinished. Provide paint finishes as indicated or required for primed finished items.
 - 4. Refer to, and coordinate with, separate documents prepared by Interior Designer for other specific paint selections and requirements.

1.3 QUALITY ASSURANCE

- A. Applicator: Company specializing in commercial painting and finishing with 5 years documented experience.
- B. Single Source Responsibility: Obtain materials for each type finish system required from one source, and from a single primary manufacturer, as standard products of manufacturer, with primers and undercoat materials produced by the manufacturer of finish coats. Use only thinners recommended by coating manufacturer and only within recommended limits.

1.4 WORK NOT TO BE PAINTED

- A. Prefinished Products:
 - 1. Ceramic tile.
 - 2. Stainless steel, brass, copper, chrome, anodized and prefinished aluminum, and ornamental metals, except as otherwise indicated or specified.
- B. Work indicated to remain unfinished and surfaces specified or scheduled to receive other finishes.
- C. Operating mechanisms (e.g., valve and damper operators, linkages, sensing devices, motor and fan shafts, and other similar operating mechanisms).

- D. Required labels (e.g., Underwriters' Laboratories, Inc., Factory Mutual, and other code required labels, and equipment names, identification, performance rating, or nomenclature plates) and operating instructions.
- E. Finished mechanical and electrical equipment (i.e., light fixtures, switchgear, fire sprinkler heads, and other similar equipment), except as specified in this Section.

1.5 ACTION SUBMITTALS

- A. General: Submittals to be provided to Interior Designer or as otherwise directed by Owner.
- B. Product Data: For each type of product submit manufacturer's specifications and technical data, including substrate preparation and installation instructions.
 - 1. Include required minimum wet film thickness for installation.
 - 2. Indicate VOC content.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat require for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.6 WARRANTY

- A. Warrant paint for two years against loss of adherence, blisters, running, peeling, scaling, chalking, streaks, stains, and other defects detrimental to performance or appearance.
- B. Refinish defective and unsatisfactory work at no additional cost.

PART - 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Material Compatibility: Provide materials for use within each paint 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.
- B. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Colors: As indicated, or as selected by Owner, Architect, or Interior Designer and included in other Documents for Finishes and Color Selections.

2.2 MANUFACTURER

- A. Manufacturer: Subject to compliance with requirements, provide products by a manufacturer as specified by the Owner or by the Interior Designer as approved by the Owner and Architect.

2.3 PRIMERS

- A. Exterior primer for wood, stucco, cement board siding, gypsum wallboard, concrete, masonry, ferrous metal, galvanized metal, and aluminum surfaces shall be as indicated, or equal, or as recommended by the manufacturer and applied per the manufacturer's specifications.
- B. Interior primer for wood, gypsum wallboard, and metal surfaces shall be as indicated, or equal, or as recommended by the manufacturer and applied per the manufacturer's specifications.
- C. See Paint Schedule at the end of this Section.

2.4 FINISH PAINT

- A. Exterior finish paint for wood, stucco, cement board siding, gypsum wallboard, concrete, masonry, ferrous metal, galvanized metal, and aluminum surfaces shall be as indicated, or equal, or as recommended by the manufacturer and applied per the manufacturer's specifications.
- B. Interior finish paint for wood, gypsum wallboard, and metal surfaces shall be as indicated, or equal, or as recommended by the manufacturer and applied per the manufacturer's specifications.
- C. See Paint Schedule at the end of this Section.

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 work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Plaster: 12 percent.
 - 5. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 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 and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 FIELD QUALITY CONTROL

- A. The Owner reserves the right to reject as unsatisfactory any and all paint applications at any time and as often as the Owner deems necessary during the period when paint is being applied.
- B. The Owner reserves the right to request that the paint manufacturer and/or an independent testing company inspect, perform test, take samples or photographs, and/or review any surface preparation, application technique, or material handling during any stage of the job, and submit verbally and/or in writing observations to the, Owner, Architect, and/or Paint Contractor.

3.4 EXTERIOR PAINTING SCHEDULE

- A. General: Provide the following paint systems, or equal, for the various substrates indicated. Apply per the manufacturer's specifications to achieve the total dry film thickness (DFT) indicated or as otherwise required by the manufacturer. If more than one manufacturer and/or system is indicated, provide only one manufacturer's product and system, as approved by the Owner, for the substrate indicated for the total project. Paint systems shall be a single-source of responsibility for complete system for quality assurance.
 - 1. Refer also to Interior Designer and/or Owner documents, when applicable.

- B. Cementitious Surfaces; Concrete, Masonry, Stucco, and Siding:
 - 1. Standard Satin Finish Latex System:
 - a. Primer: One coat, Acrylic Masonry Primer, 3.2 mils total DFT min.
 - b. Finish: Two coats, Latex Satin, 1.5 mils DFT min. per coat.
 - 2. Alternate Elastomeric System for Stucco:
 - a. Primer: One coat, Acrylic Masonry Primer, 3.2 mils total DFT min.
 - b. Finish: Two coats, Elastomeric High Build Coating, 7.5 mils DFT min. per coat, sprayed and back-rolled.
- C. Wood and Exterior Textured Ceiling Gypsum:
 - 1. Latex System:
 - a. Primer: One coat, Exterior Latex Wood Primer, 1.4 mils total DFT min.
 - b. Finish: Two coats, Latex Satin, 1.5 mils DFT min. per coat.
- D. Ferrous Metals:
 - 1. Semi-Gloss System:
 - a. Primer: One coat, Primer, 2-4 mils DFT.
 - b. Finish: Two coats, Acrylic Semi-Gloss, 1.5 mils DFT per coat.
- E. Zinc-Coated Metal and Aluminum:
 - 1. Semi-Gloss System:
 - a. Primer: One coat, Primer, 1.5 mils DFT.
 - b. Finish: One coat, Acrylic Semi-Gloss, 1.5 mils DFT.
- F. Metal Doors:
 - 1. Latex Gloss System:
 - a. Primer: One coat, Latex Gloss Primer, 1.5 mils DFT.
 - b. Finish: One coat, Latex Gloss, 1.5 mils DFT.

3.5 INTERIOR PAINTING SCHEDULE

- A. General: Provide the following paint systems, or equal, for the various substrates indicated. Apply per the manufacturer's specifications to achieve the total dry film thickness (DFT) indicated or as otherwise required by the manufacturer. Apply per the manufacturer's specifications. Paint systems shall be a single-source of responsibility for complete system for quality assurance.
 - 1. Refer also to Interior Designer and/or Owner documents, when applicable.
 - 2. Products shall comply with VOC limits of authorities having jurisdiction.
- B. Gypsum Drywall – Walls (Satin Finish) – Typical:
 - 1. Latex System:
 - a. Primer: One coat, Latex Primer, 1.5 mils DFT.
 - b. Finish: Two coats, Latex Eg-Shell, 1.6 mils DFT per coat.

- C. Gypsum Drywall – Ceilings (Flat Finish) – Typical, except Bathrooms:
 - 1. Latex System:
 - a. Primer: One coat, Latex Primer, 1.5 mils DFT.
 - b. Finish: Two coats, Latex Flat, 1.4 mils DFT per coat
- D. Gypsum Drywall – Ceilings (Satin Finish) – Bathrooms:
 - 1. Latex System:
 - a. Primer: One coat, Latex Primer, 1.5 mils DFT.
 - b. Finish: Two coats, Latex Eg-Shell, 1.6 mils DFT per coat.
- E. Woodwork and Hardboard Doors – (Semi-Gloss Finish):
 - 1. Latex System:
 - a. Primer: One coat, Latex Primer, 1.4 mils DFT.
 - b. Finish: Two coats, Latex Semi-Gloss, 1.3 mils DFT per coat.
- F. Ferrous Metal – (Semi-Gloss Finish):
 - 1. Latex System:
 - a. Primer: One coat, Primer, 2-4 mils DFT.
 - b. Finish: Two coats, Latex Semi-Gloss, 1.3 mils DFT per coat.
- G. Zinc-Coated Metal and Aluminum - (Semi-Gloss Finish):
 - 1. Latex System:
 - a. Primer: One coat, Primer, 2-4 mils DFT.
 - b. Finish: Two coats, Latex Semi-Gloss, 1.3 mils DFT per coat.

END OF SECTION 099100

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer and coordinate with Interior Design Documents or as otherwise directed by Owner.

1.2 SUMMARY

- A. General: Toilet compartments shall be as indicated on the Drawings with the product and type specified by the Interior Designer or as selected by the Owner.
- B. Section Includes toilet compartments configured as toilet enclosures and urinal screens. One or more of the following products may be used as specified by the Interior Designer or as selected by the Owner.
 - 1. Steel toilet compartments.
 - 2. Stainless steel toilet compartments.
 - 3. Plastic-laminate-faced toilet compartments.
 - 4. Phenolic-core toilet compartments.
 - 5. Solid-plastic toilet compartments.

1.3 ACTION SUBMITTALS

- A. General: Submittals to be provided to Architect for review or as otherwise directed by Owner.
 - 1. Submit finishes to Interior Designer for selection or as otherwise directed by Owner.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of reinforcements for compartment-mounted grab bars.
 - 4. Show locations of centerlines of toilet fixtures.

1.4 QUALITY ASSURANCE

- A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221.
- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 - 1. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z.
 - 2. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvanized.
- F. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- G. Stainless-Steel Castings: ASTM A 743/A 743M.
- H. Zamac: ASTM B 86, commercial zinc-alloy die castings.
- I. Particleboard: ANSI A208.1, Grade M-2 with 45-lb density[.]
- J. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

2.2 STEEL UNITS

- A. Toilet-Enclosure Style: Floor anchored.
- B. Urinal-Screen Style: Wall hung, flat panel.
- C. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
 - 1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches 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.
- D. Urinal-Screen Construction:
 - 1. Flat-Panel Urinal Screen: Matching panel construction.
- E. Facing Sheets and Closures: Electrolytically coated or hot-dip galvanized-steel sheet with nominal base-metal (uncoated) thicknesses as follows:
 - 1. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048 inch.
 - 2. Panels: Manufacturer's standard thickness, but not less than 0.030 inch.
 - 3. Doors: Manufacturer's standard thickness, but not less than 0.030 inch.
 - 4. Flat-Panel Urinal Screens: Thickness matching the panels.
- F. Pilaster Shoes: Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- G. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets; stainless steel.
- H. Steel-Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking.
 - 1. Color: As selected by Owner or Interior Designer from manufacturer's full range.

2.3 STAINLESS STEEL UNITS

- A. Toilet-Enclosure Style: Floor anchored.
- B. Urinal-Screen Style: Wall hung flat panel.

- C. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
 - 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 of size and material adequate for panel to withstand applied downward load on grab bar of at least 250 lbf (1112 N), when tested according to ASTM F446, without deformation of panel.
 - 3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
- D. Urinal-Screen Construction:
 - 1. Flat-Panel Urinal Screen: Matching panel construction.
- E. Facing Sheets and Closures: Stainless steel sheet of nominal thicknesses as follows:
 - 1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).
 - 2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.050 inch (1.27 mm).
 - 3. Panels: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
 - 4. Doors: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
 - 5. Flat-Panel Urinal Screens: Thickness matching the panels.
- F. Pilaster Shoes: Stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
- G. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets; stainless steel.
- H. Stainless Steel Finish: Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.
 - 1. Finish: As selected by Owner or Interior Designer from manufacturer's full range.

2.4 PLASTIC-LAMINATE-FACED UNITS

- A. Toilet-Enclosure Style: Floor anchored.
- B. Urinal-Screen Style: Wall hung.
- C. Door, Panel, Screen, and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores;

with laminate applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture.

1. Core Material: Particleboard.
2. Doors and Panels: Finished to not less than 7/8 inch thick.
3. Pilasters: Provide construction to comply with one of the following:
 - a. Finished to not less than 1-1/4 inches thick and with internal, nominal 0.134-inch-thick, steel-sheet reinforcement.
 - b. Finished to 1-1/4 inches thick and with manufacturer's standard steel-sheet core laminated to both sides of honeycomb of resin-impregnated kraft paper in lieu of particleboard core.
 - c. Finished to not less than 1 inch thick and with internal, nominal 0.120-inch-thick, steel-sheet reinforcement.
- D. Pilaster Shoes: Formed from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- E. Brackets (Fittings):
 1. Stirrup Type: Ear or U-brackets, stainless steel.
- F. Plastic-Laminate Finish: One color and pattern in each room.
 1. Color and Pattern: As selected by Owner or Interior Designer from manufacturer's full range.

2.5 PHENOLIC-CORE UNITS

- A. Toilet-Enclosure Style: Floor anchored.
- B. Urinal-Screen Style: Wall hung.
- C. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.
- D. Pilaster Shoes: Fabricated from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- E. Brackets (Fittings):
 1. Stirrup Type: Ear or U-brackets, stainless steel.
- F. Phenolic-Panel Finish:
 1. Facing Sheet Finish: One color and pattern in each room.
 2. Color and Pattern: As selected by Owner or Interior Designer from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.

2.6 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Toilet-Enclosure Style: Floor anchored.
- B. Urinal-Screen Style: Wall hung.
- C. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
 - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - 2. Color and Pattern: One color and pattern in each room as selected by Owner or Interior Designer from manufacturer's full range.
- D. Pilaster Shoes: Manufacturer's standard design; polymer.
 - 1. Polymer Color and Pattern: Matching pilaster.
- E. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, chrome-plated zamac.

2.7 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - 1. Material: Stainless steel.
 - 2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
 - 3. 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 regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.8 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

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.
 - b. Panels and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached 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. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware 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 102113

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Childcare accessories.
 - 4. Under-lavatory guards.
 - 5. Custodial accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. General: The following items may be used subject to compliance requirements or as specified by the Owner or the Interior Designer and as indicated on the Drawings.
- B. Toilet Tissue (Roll) Dispenser:
 - 1. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
 - 2. Mounting: Surface mounted.
 - 3. Operation: Non-control delivery with theft-resistant spindle.
 - 4. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
- C. Combination Towel (Folded) Dispenser/Waste Receptacle-Recessed:
 - 1. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
 - 2. Mounting: Recessed with projecting receptacle.
 - a. Designed for nominal 4-inch wall depth.
 - 3. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
 - 4. Minimum Waste-Receptacle Capacity: 12 gal..
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - 6. Liner: None.

7. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
- D. Liquid-Soap Dispenser – Wall Mounted (where indicated):
1. Description: Designed for dispensing soap in liquid or lotion form.
 2. Mounting: Vertically oriented, surface mounted.
 3. Capacity: 40 fl oz.
 4. Materials: Satin-finish stainless steel, vandal-resistant, concealed wall fastening, soap refill window, hinged filler-top requires special key to open.
- E. Liquid-Soap Dispenser – Countertop Mounted (where indicated):
1. Description: Designed for dispensing soap in liquid or lotion form, 6 inch spout.
 2. Mounting: Mount through 1 inch diameter hole in countertop at each lavatory.
 3. Capacity: 34 fl oz.
 4. Materials: Bright polished chrome-plated spout, cover, and escutcheon. High-impact-resistant ABS body and shank. Shatter-resistant polyethylene container.
- A. Liquid-Soap Dispenser – Automatic Countertop Mounted (if directed by Owner or Interior Designer):
1. Description: Automatic touch-free sensor.
 2. Mounting: Mount through 1-3/8 inch diameter hole in countertop at each lavatory.
 3. Capacity: 34 fl oz.
 4. Materials: Die-cast zinc spout with satin finish. High-impact-resistant ABS body and shank. Shatter-resistant polyethylene container.
- B. Grab Bars:
1. Mounting: Flanges with exposed fasteners.
 2. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4, satin finish.
 3. Outside Diameter: 1-1/2 inches.
 4. Configuration and Length: As indicated on Drawings.
- C. Sanitary-Napkin Disposal Unit:
1. Mounting: Surface mounted.
 2. Door or Cover: Self-closing disposal-opening cover and hinged face panel with tumbler lockset.
 3. Receptacle: Removable.
 4. Material and Finish: Stainless steel, No. 4 finish (satin).
- D. Toilet Seat Cover Dispenser:
1. Mounting: Surface mounted.
 2. Capacity: Dispenses 250 single or half-fold seat covers.
 3. Material and Finish: Stainless steel, No. 4 finish (satin).
- E. Mirror Unit:

1. Frame: Stainless-steel, fixed tilt.
 - a. Finish: Satin finish, with beveled edges.
 - b. Unit extends 4 inches from wall at top and tapers to 1 inch at bottom.
 - c. Size: As indicated on Drawings.
 - d. Mirror: No. 1 quality, ¼ inch glass mirror electrolytically copper plated.

2.3 PRIVATE-USE BATHROOM ACCESSORIES

- A. General: The following items may be used subject to compliance requirements or as otherwise specified by the Owner or the Interior Designer and as indicated on the Drawings.
- B. Toilet Tissue Holder:
 1. Description: Single-roll holder.
 2. Mounting: Concealed surface mounted.
 3. Capacity: Designed for ~~4-1/2-~~ or ~~5-inch-~~ diameter tissue rolls.
 4. Finish: As selected by Interior Designer or Owner.
- C. Shower Curtain Curved Rod:
 1. Outside Diameter: ~~1 inch~~.
 2. Mounting: Flanges with concealed fasteners.
 3. Finish: As selected by Interior Designer or Owner.
- D. Towel Bar:
 1. Description: ~~5/8-inch-~~ square tube with rectangular end brackets.
 2. Mounting: Flanges with concealed fasteners.
 3. Length: As indicated on drawings.
 4. Finish: As selected by Interior Designer or Owner.
- E. Grab Bars, (where indicated on the Drawings):
 1. Mounting: Flanges with exposed fasteners.
 2. Material: Stainless steel, ~~0.05 inch~~ thick.
 - a. Finish: Smooth, No. 4, satin finish.
 3. Outside Diameter: ~~1-1/2 inches~~.
 4. Configuration and Length: As indicated on Drawings.

2.4 CHILDCARE ACCESSORIES

- A. General: The following items may be used subject to compliance requirements or as specified by the Owner or the Interior Designer and as indicated on the Drawings.
- B. Diaper-Changing Station (where indicated on drawings):
 1. Wall Mounted: Horizontal unit that opens by folding down from stored position and with child-protection strap.

- a. Engineered to support a minimum of 200-lb static load when opened.
 - b. Mounting: Surface mounted on wall, with unit projecting not more than 4 inches from wall when closed. Install to comply with ADA requirements.
 - c. Operation: By pneumatic shock-absorbing mechanism.
- 2. Material and Finish: High-density polyethylene in manufacturer's standard color.
 - 3. Liner Dispenser: Built in.
 - 4. Color: As selected by the Owner or the Interior Designer.

2.5 UNDER-LAVATORY GUARDS

- A. General: The following items may be used subject to compliance requirements or as specified by the Owner or the Interior Designer and as indicated on the Drawings.
- B. Under-lavatory Guard (where required):
 - 1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
 - 2. Material and Finish: Antimicrobial, molded-plastic, white.

2.6 CUSTODIAL ACCESSORIES

- A. General: The following items may be used subject to compliance requirements or as specified by the Owner or the Interior Designer and as indicated on the Drawings.
- B. Mop and Broom Holder:
 - 1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - 2. Length: 36 inches.
 - 3. Hooks: Three.
 - 4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.7 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least **250 lbf**, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 103050 - MANUFACTURED FIREPLACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer and coordinate with Interior Design Documents or as otherwise directed by Owner.

1.2 SUMMARY

- A. This Section is intended to include the provisions necessary to accomplish all manufactured fireplace installations for the Project.

1.3 SUBMITTALS

- A. General: Submittals to be provided to Interior Designer or as otherwise directed by Owner.
- B. Product Data: Manufacturer's data for indicated fireplace installations. Include instructions for installation, operation and maintenance instructions and related information.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fireplace and components through one source from a single manufacturer.
- B. Provide specified fireplace with all components and installations required and necessary for a complete and properly operating fireplace, as required by applicable codes.

1.5 WARRANTY

- A. Provide manufacturer's warranty for manufactured fireplaces that warrants systems to be free from defects in materials, manufacturing, workmanship, and installation during the indicated warranty period.

B. PART 2 – PRODUCTS

2.1 MANUFACTURER / PRODUCTS

- A. Products: Subject to compliance with requirements, provide products from a manufacturer as selected by Interior Designer and approved by the Owner and Architect.
 - 1. Manufactured Fireplaces:
 - a. Type: Gas or Electric, per the Owner.
 - b. Size: As required by the Owner.
 - c. Bi-fold look glass door, if required by Owner.
- B. As necessary, verify with Owner / Interior Designer regarding all optional features and finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate and conditions under which fireplace system are to be installed. Do not begin work until unsatisfactory conditions have been corrected and determined acceptable. Initiation of work indicates acceptance of substrate as satisfactory by the installer.

3.2 INSTALLATION

- A. Install systems and components to comply with manufacturer's installation instructions, to conform to applicable standards and codes, and as required by the Authorities Having Jurisdiction.

3.3 ADJUSTMENTS

- A. Final System Check: Verify that all fireplace components are properly installed and operate or function correctly.
- B. Verify that all accessories, operation and maintenance manuals, and warranties have been received and are proper in all respects.

END OF SECTION 103050

SECTION 104415 - FIRE EXTINGUISHERS AND CABINETS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY

- A. Extent of fire extinguishers and cabinets are indicated on Contract Drawings.
- B. Types of products required include:
 - 1. Fire extinguishers.
 - 2. Mounting brackets, where indicated on drawings.
 - 3. Cabinets, where indicated on drawings.

1.3 QUALITY ASSURANCE:

- A. Single Source Responsibility: Obtain products in this Section from one manufacturer.
- B. UL Listed Products: Provide new portable fire extinguishers which are UL listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.
- C. FM Listed Products: Provide new portable fire extinguishers which are approved by Factory Mutual Research Corporation for type, rating, and classification of extinguisher indicated and carry appropriate FM marking.

1.4 ACTION SUBMITTALS:

- A. Product Data: Submit product data for each type of product included in this Section.

PART 2 – PRODUCTS

2.1 FIRE EXTINGUISHERS:

- A. Provide fire extinguishers and mounting brackets, one per apartment and at other locations indicated on the Drawings, in colors and finishes as selected from manufacturer's standard which comply with requirements of governing authorities.
 - 1. Owner/Property Management shall provide service through local vendor to fill and service extinguishers to comply with requirements of governing authorities and manufacturer's requirements.

- B. Abbreviations indicated below to identify extinguisher types related to UL classification and rating system and not, necessarily to type and amount of extinguishing material contained in extinguisher.
- C. Multi-Purpose Dry Chemical Type: Minimum UL rated 2A-10B:C; 5 pound nominal capacity, for Class A, Class B and Class C fires, or as required by local authorities.
- D. Commercial Kitchen Areas, (if applicable) with Wet Chemical Type: Class K, per NFPA-10, size as required by local authorities.

2.2 CABINETS AND MOUNTING:

- A. Cabinets: Provide surface mounted and semi-recessed mounted steel cabinets where indicated on the Drawings. Provide fire rated cabinets for semi-recessed locations in rated walls.
 - 1. Door: Full glass door with clear tempered glass.
 - 2. Finish: To be selected by the Interior Designer.
- B. Brackets: Provide manufacturer's standard brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.
- B. Unless indicated otherwise, install mounting brackets and fire extinguishers in base cabinet under kitchen sink in each apartment unit where indicated on plan.
- C. Install semi-recessed mounted cabinet and fire extinguishers in walls as indicated on Drawings.
- D. Install mounting brackets and fire extinguishers on wall at other locations as indicated on Drawings.

END OF SECTION 104415

SECTION 105500 - POSTAL SPECIALTIES

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. Horizontal apartment mailboxes.
 - 2. Collection boxes.
 - 3. Parcel room system.
 - 4. Parcel locker system.

1.3 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Include plans, elevations, sections, fabrication details and attachments to other work. Also include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty. Also include:
 - 1. Identification sequence for compartments.
 - 2. Layout of identification text.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Use an authorized representative of postal specialty manufacturer for installation of units required for this Project.
- B. Source Limitations: Obtain postal specialties through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of postal specialties and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

1. Coordinate with Owner for the name of Owner's representative who will receive the keys.

1.6 COORDINATION

- A. Coordinate layout and installation of recessed postal specialties, if any, with wall construction.
- B. Templates: Obtain and distribute to parties involved, templates for installing postal specialties.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of postal specialties that fails in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of hardware, except door locks.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Unless required otherwise by governing authorities, 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. Key Blanks: Furnish not less than **2** key blanks for every lock, of each type of compartment door lock installed, or as otherwise requested by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturer: Subject to compliance with requirements, provide products by a manufacturer that may be incorporated into the Work as approved by the Owner and Architect.
 2. Products: Comply with USPS STD-4C requirements.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, and as follows:
 1. Sheet and Plate: ASTM B 209.

2. Extruded Shapes: ASTM B 221.
- B. Steel Sheet: Cold rolled, ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- C. Metallic-Coated Steel Sheet: Galvanized steel sheet, ASTM A 653/A 653M, G60 coating designation; or electrolytic zinc-coated steel sheet, ASTM A 591/A 591M, Class C coating.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
- E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 HORIZONTAL APARTMENT MAILBOXES

- A. USPS-Approved, Front-Loading, Horizontal Apartment Mailboxes as indicated on Drawings, and consisting of multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS Regulations and Standards.
 1. Compartments: As indicated on Drawings, and of sizes following:
 - a. USPS Approved STD 4C
 2. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; with master door lock and concealed, full-length, stainless-steel piano hinge on one side. Fabricate master door to remain open while mail is deposited.
 - a. Master Door Lock: Prepare master door to receive lock furnished by local postmaster.
 3. Compartment Doors: Fabricated from aluminum sheet reinforced with vertical stiffeners. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide one compartment with outgoing mail slot and prepared for master door lock.
 - a. Tenant Identification: Laminated, black plastic tabs, engraved with identification and adhesively applied to face of compartment door.
 - b. Compartment Door Locks: 5-pin tumbler, cylinder cam locks capable of at least 1000 key changes; with 2 keys for each compartment door. Key each compartment differently.
 4. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder for tenant's identification behind each compartment.
 - a. Provide cardboard identification tab with space for printing tenant name and apartment number.
 5. Snap-on Trim: Fabricated from same material and finish as compartment doors.
 6. Concealed Components and Mounting Frames: Aluminum or steel sheet.
 7. Aluminum Finish: Finish surfaces exposed to view as follows:
 - a. Finish: As indicated on the Drawings.

2.4 COLLECTION BOXES

- A. USPS-Approved, Front-Loading, Collection Boxes as indicated on drawings, and consisting of single compartment with fire-resistant cushion bottom, enclosed within wall box, with mail slot to receive mail. Provide access to compartment for collecting mail from front of unit. Comply with USPS Regulations and Standards.
1. Mounting: Recessed.
 2. Type: Auxiliary collection box.
 3. Overall Height: As shown on Drawings.
 4. Compartment Door and Frame: Fabricated from 1/4-inch- thick metal plate, with opening not less than 12 by 20 inches and not more than 18 by 30 inches. Equip door with lock and concealed, full-length, flush hinge on one side.
 - a. Door Lock: Door prepared to receive lock furnished by local postmaster.
 5. Mail Slot: Fabricated from 1/4-inch- thick metal plate, with 11-inch-wide by 1-1/4-inch- high opening, protected by inside hood and hinge flap, and with inside baffle to prevent removal of mail from box.
 6. Style: Compartment and hopper doors set within face frame.
 7. Concealed Components and Mounting Frames: Aluminum or steel sheet.
 8. Identification: Engrave face of unit with 1-inch- high letters as follows: "U.S. MAIL LETTER BOX" on 2 lines at top or bottom of unit.
 9. Schedule-Card Holder: Provide recessed or surface-mounted holder for schedule card in center of bottom front portion of unit. Fabricate of same material and finish as front of unit.
 10. Mailbag Rack: Provide internal rack system for supporting mailbags within unit.
 11. Finish: As indicated on the Drawings.

2.5 PARCEL ROOM SYSTEM

- A. Parcel room system with a touchscreen kiosk-resident notification for package delivery, powered by a Windows operating system, barcode scanner, RFID reader, and 24/7 CCTV security camera.
1. Installation: Install per Manufacturer's requirements.

2.6 PARCEL LOCKER SYSTEM

- A. Parcel locker system with a touchscreen kiosk-resident notification for package delivery, powered by a Windows operating system, barcode scanner, RFID reader, and 24/7 CCTV security camera.
- B. USPS-Approved, Front-Loading, Lobby Parcel Lockers as indicated on drawings: Consisting of multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming parcels from front of unit. Provide access to each compartment for removing parcels by swinging compartment door. Comply with USPS Regulations and Standards.
1. Include: Amazon Lockers as directed by Owner or otherwise indicated on Drawings.

2.7 ACCESSORIES

- A. Key Cabinets: Wall-mounted, metallic-coated steel cabinet with pivoting, key-holding panels and side-hinged door equipped with five-pin tumbler, cylinder door lock and concealed, full-length flush hinge. Finish cabinet, panels, and door with baked-enamel finish. Provide key control system consisting of key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers.
 - 1. Capacity: Keys for 150 percent of the number of apartment mailbox locks.
 - 2. Cross-Index System: Consisting of index cards for recording key information. Include three receipt forms for each key-holding hook.

2.8 FABRICATION

- A. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs, and safe to touch.
- B. Form joints exposed to weather to exclude water penetration.
- C. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation.

2.9 FINISHES

- A. Finish postal specialties after assembly.
- B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 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. Steel Finishes: Unless otherwise indicated, finish steel surfaces exposed to view with baked-enamel or powder-coated finish.
- E. Steel Surface Preparation: 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."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, roughing-in openings, clearances, and other conditions affecting performance of work.

3.2 INSTALLATION

- A. Metal Protection: Where aluminum and copper alloys will contact grout, concrete, masonry, wood, or dissimilar metals, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation.
- B. Final acceptance depends on compliance with USPS requirements.
- C. Accessibility: Install as required to comply with applicable accessibility requirements as necessary to comply with the Building Code and Authority Having Jurisdiction.
- D. Horizontal Apartment Mailboxes: Install horizontal apartment mailboxes with center of tenant-door lock cylinder as required to comply with applicable accessibility limits for units required to be accessible. Bottom of lowest compartment not less than 28 inches above finished floor.
 - 1. Arrange compartments in groups, with not more than 35 and not less than 4 compartments operated by 1 master lock.
- E. Collection Boxes: Install collection boxes with bottom of mail slots as required to comply with applicable accessibility limits.
- F. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.3 FIELD QUALITY CONTROL

- A. Arrange for USPS personnel to test collection boxes after installation according to USPS regulations.
- B. Obtain written final approval from USPS postmaster that authorizes mail collection.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.

END OF SECTION 105500

SECTION 105723 - WIRE SHELVING

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 is intended to include the provisions necessary to accomplish all wire closet and storage type shelving installations for the Project.
- B. Section Includes:
 - 1. Ventilated wire shelving.
 - a. Fixed shelf systems.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Data: Submit manufacturer's literature indicating data for types of installations required for this Project.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain all shelving units, components and accessories through one source from a single manufacturer.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

1.5 PRODUCT HANDLING

- A. Store and protect materials to comply with manufacturer's instructions. Store materials in enclosed areas protected from physical damage and weather.
- B. Immediately remove from Project site all materials that are damaged or deteriorated, and all packaging and other debris resulting from these installations.

PART 2 - PRODUCTS

2.1 SHELVING MATERIALS / FINISH / FABRICATION

- A. Provide Manufacturer's standard units as approved by the Owner and Architect.
- B. Materials: Fabricate from C-1006, basic cold drawn steel with average tensile strength of 100,000 PSI. Weld all rods at intersection of cross deck wire.
 - 1. Deck rods spacing: 5/8 to 1 inch increments.
 - 2. Trim cross deck wires smooth to longitudinal wires.
- C. Finish:
 - 1. Basic Finish: White vinyl coating; PVC to thickness of 7-17 mils.
 - 2. Alternate: Baked-on coated color: White or Nickel, as selected by the Owner.
- D. Mounting Hardware: Provide components as required or recommended for shelving installation to drywall without requiring mounting to concealed wall structural members.
 - 1. Accessories include, but not limited to, the following:
 - a. Wall Clips.
 - b. End Brackets.
 - c. Support Brackets.
 - d. Hanging Rails.
 - e. Poles.
 - f. Standards.
 - g. Shelf Brackets.
 - h. Pole Clips.
 - 2. Provide intermediate support for spans over 36 inches or as recommended by the manufacturer.
- E. Shelving Unit Features:
 - 1. Size: Typical closet shelving to be 12 inches deep, with hanging bar. Linen or pantry closet shelving to be 16 inches deep.
 - 2. Refer to Drawings for locations and other shelf depths (if any), and for layout and shelf lengths.
 - 3. Refer to Drawings for locations of adjustable shelving.
 - 4. Where depths or lengths cannot be determined from the Drawings verify requirements with Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine Project prior to installation of gypsum board walls and verify location and adequacy of blocking and backing material or as required by the manufacturer.
- B. Correct all defects prior to commencing shelving installations.
- C. Erect shelving plumb, true and square, in a substantial manner.
- D. Where the unsupported span exceeds the maximum spans specified above, install brackets at mid span.
- E. Install all material as recommended by the manufacturer and as required for minimum loading requirements specified or to be expected.

1. Install shelves to withstand a static load of 40 lbs. per lineal foot.
- F. Unless approved otherwise, attach shelving standards and supports to studs or blocking behind gypsum board or as required by the manufacturer.
- G. Support linen and storage shelving, where ends are not supported by wall brackets, by manufacturers standard vertical support pole.
 1. Provide combination support / hold down clip every 12 in. o.c.

3.2 CLEANING

- A. As work proceeds, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris related to this work.
- B. Upon completion of installation, clean all surfaces that have become soiled during installation.

END OF SECTION 105723

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work of this Section is intended to include the provisions necessary to accomplish all residential appliances / equipment installations required by the Project.
- B. Section Includes:
 - 1. Cooking appliances.
 - 2. Kitchen exhaust ventilation.
 - 3. Refrigeration appliances.
 - 4. Cleaning appliances.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of residential appliance and equipment, including data indicating compliance with requirements. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.
- B. ENERGY STAR Documentation: Submit documentation for applicable appliances that are ENERGY STAR rated. Applies to Dishwashers, Refrigerators, and Clothes Washers.
- C. Warranties: Sample of special warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals to be submitted to the Owner by the Contractor.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain residential appliances through one source. Provide products from same manufacturer for all of each type appliance required.
- C. 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.

- D. Regulatory Requirements: Comply with provisions of the following product certifications:
1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
- E. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Minimum one-year warranty from date of Substantial Completion, unless otherwise noted.

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 products by a manufacturer as selected by the Owner, subject to the Architect's review.
 2. **ENERGY STAR Rated, where applicable.**
 3. Accessible: Provide appliances compliant with applicable accessible requirements where required as indicated on the Drawings.
 4. Color: To be selected by the Owner or the Interior Designer.

2.2 APPLIANCES

- A. General: All appliances shall be as selected and approved by the Owner and subject to the Architect's review. The following is a list of typical appliances that may be included in the project, subject to Owner approval.
- B. Dwelling Unit Kitchens:
1. Electric Range/Oven; full size, free-standing
 - a. Rear controls for typical Units.
 - b. Anti-tip device: Manufacturer's standard.
 - c. Radiant Smoothtop.
 - d. Standard-Clean Oven.
 2. Range Hood/Microwave

- a. Exhaust: Recirculating, Non-vented, 2-speed fan.
 - b. Microwave Capacity: 1.6 cu. ft., 1000 Watts
 - c. Light: Incandescent.
- 3. Refrigerator/Freezer
 - a. Two-door, top-freezer w/ ice-maker.
 - b. Capacity: 21 cu. ft. or as directed by Owner.
 - c. Self-defrosting.
- 4. Dishwasher
 - a. Built-in, under-counter, (36" high counter).
 - b. Controls: Electronic, touchpad, front controls.
 - c. Cycles: 5 cycles.
 - d. Sound level: 60 dBA.
- 5. Disposer
 - a. Motor: 1/3 hp.
 - b. Grinding Speed: >2500 RPM.
 - c. Power Connection: Line cord or direct wired, as indicated.
- C. Dwelling Unit Laundry
 - 1. Clothes Washer
 - a. Top-Loading.
 - b. Capacity: 4 cu. ft.
 - c. Cycles: 16 cycles.
 - 2. Clothes Dryer
 - a. Electric dryer.
 - b. Capacity: 7 cu. ft.
 - c. Temperature Settings: 4 heat selections.
 - d. Venting Capability: up to 60 feet (w/ one 90 degree elbow)
 - 3. Stack Washer/Dryer (where indicated)
 - a. Washer Capacity: 3 cu. ft.
 - b. Dryer Capacity: 6 cu. ft.
 - c. Venting Capability: up to 44 feet (w/ one 90 degree elbow)
- D. Clubhouse/Amenities Kitchenette Appliances (where applicable):
 - 1. General: Provide appliances listed for exterior conditions where required.
 - 2. Under-counter Refrigerator
 - a. Capacity: 5.6 cu. ft. or as directed by Owner.
 - b. ADA Compliant.
 - 3. Under-counter Ice Maker
 - a. ADA Compliant.
 - 4. Dishwasher
 - a. Built-in, under-counter.
 - b. Controls: Electronic, touchpad, front controls.
 - c. Cycles: 4 cycles.

- d. Sound level: 52 dBA.
 - e. ADA Compliant.
- 5. Countertop Microwave Oven
 - a. Capacity: 1.5 cu. ft.
 - b. Watts: 1100 W.
 - c. ADA Compliant.
- 6. Disposer
 - a. Motor: 1/3 hp.
 - b. Grinding Speed: >2500 RPM.
 - c. Power Connection: Line cord or direct wired, as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations.
- B. Built-In Equipment: Securely anchor units to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate for proper operation of equipment.

3.2 ADJUSTING AND CLEANING

- A. Testing: Test each item of residential equipment to verify proper operation. Make necessary adjustments.
- B. Accessories: Verify that accessory items required have been furnished and installed.
- C. Cleaning: Remove packing material from residential equipment items and leave units in clean condition, ready for operation.

END OF SECTION 113100

SECTION 118226 - FACILITY WASTE COMPACTORS

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 waste compactors.
 - 1. Waste compactors meeting all requirements of the Authority Having Jurisdiction will be provided by the Owner.
 - 2. Contractor to coordinate and provide all labor, materials, and equipment necessary for a complete and finished installation as indicated on the Drawings, required by code, or herein specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties and accessories, and finishes.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For waste compactors to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than one-hour normal travel time from Installer's place of business to Project site.
- B. Waste-Compactor Standards: ANSI Z245.21 and NFPA 82.
- C. Waste-Container Standards: ANSI Z245.30 and ANSI Z245.60.

PART 2 - PRODUCTS

2.1 WASTE COMPACTORS

- A. Waste Compactor: Manufacturer's standard self-contained compactor, complying with requirements and with components, options, and accessories needed to provide a complete, functional system.
 - 1. Manufacturer / Model: Selected by Owner:
 - a. Contractor to verify compactor manufacturer and model number with Owner and confirm installation requirements prior to construction of enclosure.

2.2 FABRICATION

- A. Fabricate waste compactors with smooth, eased, exposed edges to prevent injury to persons in vicinity of the equipment.
- B. Fabricate containers, hoppers, compaction chambers, unit bodies, and similar components of steel with welded joints. Reinforce with steel members sized and spaced to withstand impacts and pressures of normal operations and to prevent deformation.
- C. Fabricate equipment with replaceable parts at points of normal wear.
- D. Fabricate liquidtight compactor baffles to stop liquid from leaking out.
- E. Fabricate diverter to fit chute and properly align with compactor hoppers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, clearances, service rough-ins, and other conditions affecting performance of waste-compactor work.
- B. Examine walls, floors, and chutes for suitable conditions where each waste compactor will 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. Installation: Contractor shall be completely responsible for all labor and materials necessary for complete installation of trash compactor, including all required electrical

and plumbing connections, unit attachments, and all other work required for installation.

- B. Install each waste compactor according to manufacturer's written instructions, ANSI Z245.2, and ANSI Z245.21.
- C. Set waste compactors properly aligned and securely in place. Anchor as required for secure operation.
- D. Install diverter to chute and properly align with compactor hoppers.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Certify compliance with test parameters.
- C. A waste compactor will be considered defective if it does not pass tests and inspections.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain waste compactors according to manufacturer's requirements and ANSI Z245.2.

END OF SECTION 118226

SECTION 122000 – WINDOW AND DOOR TREATMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of possible window and door treatments and accessories that may be specified by the Interior Designer. [Coordinate with and refer to the Interior Designer documents or Owner for actual selected products and locations.](#)
 - 1. Horizontal blinds.
 - 2. Vertical blinds.
 - 3. Drapery hardware.
 - 4. Roller shades, for storefront windows.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 6 Section "Rough Carpentry" for wood blocking and grounds for mounting window and door treatments.

1.3 ACTION SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections directly to the **Interior Designer for review or as otherwise directed by the Owner.**
- B. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, installation and operating instructions.
- C. Samples for Verification: For the following products, prepared on Samples from the same material to be used for the Work.
 - 1. Louver Slat: Not less than **12 inches** long.
- D. Maintenance Data: Include the following in maintenance manuals for Owner:
 - 1. Methods for maintaining products and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
 - 3. Operating hardware.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain products through one source from a single manufacturer.
- B. Provide certified lead free material.
- C. Fire-Test-Response Characteristics: Provide horizontal louver blinds identical to those tested for the following fire-test-response characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Test Method: NFPA 701.
 - 2. Rating: Pass.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in factory packages, marked with manufacturer and product name and location of installation using same room designations indicated on Drawings, in a window treatment schedule, or as directed by Interior Designer or Owner.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products by manufacturers that may be incorporated in the Work as specified by the Owner or the Interior Designer.

2.2 HORIZONTAL LOUVER BLINDS

- A. Louvers: Manufacturer's standard as follows unless otherwise specified by Interior Designer or otherwise directed by Owner:
 - 1. Vinyl Faux Wood:
 - a. Nominal Louver Width: 2 inch.

- b. Thickness: .006 inches minimum.
- 2. Vinyl mini-blinds:
 - a. Nominal Louver Width: 1 inch for mini-blinds.
- 3. Aluminum alloy mini-blinds:
 - a. Nominal Louver Width: 1 inch for mini-blinds.
- B. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends.
- C. Bottom Rail: Formed-steel or extruded-aluminum tube, sealed with plastic or metal capped ends bottom contoured for minimizing light gaps; with enclosed and protected ladders and tapes to prevent their contact with sill.
- D. Tilt Control: Consisting of enclosed worm gear and linkage rod, for the following operation:
 - 1. Tilt Operation: Manual with clear plastic wand.
 - 2. Tilt Function: Full.
- E. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.
- F. Valance: Match color of louvers.
- G. Colors: As selected by Interior Designer or Owner from the complete line of manufacturers colors.
- H. Mounting: Unless otherwise specified by Interior Designer or Owner, wall mounting within window opening as required by Project conditions, permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
 - 1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

2.3 VERTICAL LOUVER BLINDS

- A. Rail System: Headrail.
 - 1. Rails: Extruded aluminum or manufacturer's standard; long edges returned or rolled; channel-shaped, enclosing operating mechanisms.
- B. Vane: Faux wood PVC, not less than 3/8-inch overlap when vanes are rotated fully closed.
 - 1. Nominal Vane Width: 3-1/2 inches.
- C. Vane Directional Control: Manual with wand.

- D. Traversing Control: Manual with wand.
- E. Draw and Stack Position: As selected by Owner or Interior Designer.
- F. Mounting: Concealed wall (face) mounting, unless indicated otherwise, permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
- G. Colors, Textures, Patterns, and Gloss: As selected by Interior Designer or Owner from manufacturer's full range.

2.4 DRAPERY HARDWARE

- A. General: Provide rods, brackets, and end caps as specified and where indicated by Interior Designer or as directed by Owner.

2.5 ROLLER SHADES (for storefront windows)

- A. General: Provide fabrics in textures, patterns, colors, and openness factor as specified by Interior Designer or as directed by Owner for storefront windows where indicated, including lift system and all required hardware.

2.6 FABRICATION

- A. General: Fabricate per manufacturer's standards and provide all required components, hardware, and fasteners required for complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install products level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than **1 inch** to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any. Provide installations for mounting conditions as specified by manufacturer.

3.3 ADJUSTING

- A. Adjust window and door treatments to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean blind surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that product are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged products that cannot be repaired, in a manner approved by Owner and Architect, before time of Substantial Completion.

END OF SECTION 122000

SECTION 123540 - RESIDENTIAL CASEWORK AND COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to Drawings by the Interior Designer, if applicable, for specified products and materials.

1.2 SUMMARY

- A. This Section includes the following (to be selected by the Interior Designer or the Owner):
 - 1. Cabinets for Kitchens and Vanities.
 - 2. Cabinet hardware.
 - 3. Countertops, backsplashes, and endsplashes, (where applicable and as selected by the Interior Designer or the Owner):
 - a. Plastic-laminate.
 - b. Granite.
 - c. Solid-surface-material.
 - d. Quartz agglomerate.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following, (as selected by the Interior Designer or the Owner):
 - 1. Cabinets.
 - 2. Cabinet hardware.
 - 3. Countertops, backsplashes, and endsplashes.
- B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.
- B. Quality Standards: Unless otherwise indicated, comply with the following standards:
 - 1. Cabinets: KCMA Certification and ANSI specification A161.1.

- a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semi-exposed location of each unit and showing compliance with the above standard.
2. Plastic-Laminate Countertops: KCMA A161.2, NEMA LD 3.
3. Granite Countertops: ASTM C 615.
4. Solid-Surface-Material Countertops: ANSI SS1.
5. Quartz Agglomerate: ANSI SS1.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework 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. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.
- C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.
- D. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.6 COORDINATION

- A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.
- B. Coordinate locations of utilities that will penetrate countertops, backsplashes, and endsplashes.

PART 2 - PRODUCTS

2.1 CABINETS

- A. General: The design for cabinets is based on industry standards and typical sizes provided by most cabinet manufacturers. Selection of the manufacturer and cabinet products shall be determined and/or approved by the Interior Designer or the Owner and are subject to the Architect's review. See Drawings for layout and locations of each cabinet.
- B. Cabinet Products:
 1. Type and Style: Selected by the Interior Designer or the Owner.
 2. Material: Selected by the Interior Designer or the Owner.

3. Color: Selected by the Interior Designer or the Owner.

2.2 CABINET MATERIALS

- A. General: Cabinets, depending on the Interior Designer's or the Owner's approved manufacturer and type, may be constructed of any of the following materials:
 1. Hardwood Lumber: Kiln dried to 7 percent moisture content.
 2. Softwood Lumber: Kiln dried to 10 percent moisture content.
 3. Plywood: Cabinet grade plywood per manufacturer.
 4. Particleboard: ANSI A208.1, Grade M-2.
 5. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
 6. Hardboard: AHA A135.4, Class 1 Tempered.
- B. Exposed Materials: Manufacturer's standard materials for style specified.
- C. Semi-exposed Materials: Manufacturer's standard materials for style specified.
- D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.
- E. Cabinet Materials and Construction: Shall be approved by the Interior Designer or the Owner and subject to the Architect's review.

2.3 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by the Interior Designer or the Owner from manufacturer's full range.
- B. Pulls: Manufacturer, style, and finish as specified by the Interior Designer or the Owner.
- C. Hinges: Concealed European-style self-closing hinges.
- D. Drawer Guides: Cabinet manufacturer's standard, self-closing drawer guides.

2.4 PLASTIC-LAMINATE COUNTERTOPS (where applicable)

- A. Configuration: Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and endsplash style or as otherwise indicated by the Interior Designer or the Owner.
- B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3. See Drawings by the Interior Designer, where applicable, for types and locations of each plastic-laminate material.
 1. Manufacturers: Subject to compliance with requirements, provide products by a manufacturer as selected by the Interior Designer or the Owner.
 2. Grade: HGP.

3. Colors, Textures, and Patterns: As selected by the Interior Designer or the Owner from plastic-laminate manufacturer's full range.

C. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch thick.

1. For countertops at sinks and lavatories, use Grade M-2-Exterior-Glue particleboard or exterior-grade plywood.
2. Build up countertop thickness to 1-1/2 inches front, back, and ends with additional layers of particleboard laminated to top.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, and touch sanded.

2.5 GRANITE COUNTERTOPS (where applicable)

A. Granite: Provide granite countertops, backsplashes, and endsplashes in sizes and shapes required to comply with requirements indicated, including details on the Drawings and as specified by the Interior Designer or the Owner.

1. Manufacturers: Subject to compliance with requirements, provide products by a manufacturer as selected by the Interior Designer or the Owner.
2. Thickness: As specified by the Interior Designer.
3. Edge: As specified by the Interior Designer.
4. Finish: As specified the Interior Designer.
5. Colors, Textures, and Patterns: As selected by the Interior Designer or the Owner from manufacturer's full range.

2.6 SOLID-SURFACE-MATERIAL COUNTERTOPS (where applicable)

A. Solid-surface-material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

B. Provide solid-surface-material countertops, backsplashes, and endsplashes in sizes and shapes to comply with requirements indicated, including details on the Drawings and as specified by the Interior Designer or the Owner.

1. Manufacturers: Subject to compliance with requirements, provide products by a manufacturer as selected by the Interior Designer or the Owner.
2. Type: Standard type, unless otherwise selected by the Interior Designer or the Owner.
3. Colors and Patterns: As selected by the Interior Designer or the Owner.

2.7 QUARTZ AGGLOMERATE (where applicable)

A. Quartz agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

B. Provide quartz agglomerate countertops, backsplashes, and endsplashes in sizes and shapes to comply with requirements indicated, including details on the Drawings and as specified by the Interior Designer or the Owner.

1. Manufacturers: Subject to compliance with requirements, provide products by a manufacturer as selected by the Interior Designer or the Owner.
2. Colors and Patterns: As selected by the Interior Designer or the Owner.

2.8 ACCESSORIES

- A. Accessories: Provide all required accessories as recommended by the manufacturer for complete installation, where applicable, including but not limited to the following items:
1. Water-Cleanable Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Stone Adhesive: 2-part epoxy or polyester adhesive, formulated specifically for bonding stone to stone, with an initial set time of not more than 2 hours at 70 deg F, and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Color: Match stone.
 4. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below and will not stain the stone it is applied to.
 - a. Single-component, neutral-curing silicone sealant.
 - b. Color: As selected by the Interior Designer or the Owner.
 - c. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 5. Stone Cleaner: Cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
 6. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
- C. Fasten cabinets to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, or blocking.
- D. Install countertops, backsplashes, and endsplashes as recommended by the manufacturer to comply with requirements shown on the Drawings and as indicated by the Interior Designer or the Owner.
- E. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.
 1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
 2. Install with uniform joints.

3.2 ADJUSTING AND CLEANING

- A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Replace all defective or damaged items that cannot be repaired to meet approval by the Owner, Interior Designer, and Architect.
- D. Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately. Clean per manufacturer's written instructions.
- E. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION 123540

SECTION 142100 - ELECTRIC TRACTION ELEVATORS

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 electric traction, machine room-less, passenger elevator.

1.3 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
 - 1. Car enclosures and hoistway entrances.
 - 2. Operation, control, and signal systems.
 - 3. Color selection charts for cab and entrances.
- B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain elevators through one source from a single manufacturer.
 - 1. Provide major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.
- C. Regulatory Requirements: Comply with ASME A17.1.
- D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA),

Accessibility Guidelines for Buildings and Facilities (ADAAG)", the Uniform Federal Accessibility Standards (UFAS), and the Fair Housing Act Design Manual.

- E. Fire-Rated Hoistway Entrance Assemblies: Door and frame 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 at as close to neutral pressure as possible according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
- B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.6 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate sequence of elevator installation with other work to avoid delaying the Work.
- C. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders, sumps, entrance subsills, and electrical service, electrical outlets, lights, and switches in pits and hoistways.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

- 1. Warranty Period: One year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, 7-day-per-week emergency callback service.
 - a. Response Time: Two hours or less.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Subject to compliance with requirements, provide products by manufacturers that may be incorporated into the Work acceptable to the Owner and subject to the Architect's review.
 1. Machine Room-Less, gearless traction elevator.
 - a. Capacity: 2,500 lbs., minimum, with side-opening door.
 - b. Interior Elevator Car Size: Per manufacturer, (must accommodate an ambulance stretcher, 24" x 76" or as otherwise specified by Code and the AHJ).
 - c. Interior Elevator Car Height: Minimum of 9'-0" high, (minimum of 8'-0" finished ceiling height), or as otherwise indicated or directed by the Owner or Interior Designer.
 - d. Door Width and Height: 3'-6" wide x 8'-0" high or as otherwise indicated on Drawings.
 - e. Speed: 150 fpm, unless otherwise indicated or directed by the Owner.
 - f. Equipment Control: Manufacturer's standard equipment control. Location as indicate on Drawings or as otherwise required per the manufacturer.

2.2 SYSTEMS AND COMPONENTS

- A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered elevator systems and as required for complete system.

2.3 CAR ENCLOSURES

- A. General: Provide manufacturer's steel-framed car enclosures with car roof, access doors, power door operators, and ventilation.
 1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
 2. Provide finished car including materials and finishes specified below.
- B. Materials and Finishes: Provide manufacturer's standards, but not less than the following, unless otherwise specified by the Interior Designer.
 1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch nominal thickness.

2. Floor Finish: Specified in a Division 09 Section, as specified by Interior Designer or Owner.
3. Wall Panels: Brushed stainless steel, or as otherwise specified by Interior Designer or Owner.
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. Doors: Brushed stainless steel.
7. Sight Guards: Provide sight guards on car doors.
8. Threshold: Aluminum.
9. Ceiling: Round diffusers in stainless frame – LF-2; stainless steel with satin finish, three panel suspended ceiling with fluorescent lights, or as otherwise specified by Interior Designer or Owner. **Finished ceiling height to be 8'-0" minimum, unless otherwise indicated or directed by the Owner or Interior Designer.**
10. Handrails: Round tube stainless steel with satin finish – 1.5 inches.

2.4 HOISTWAY ENTRANCES

- A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

2.5 SIGNAL EQUIPMENT

- A. General: Provide manufacturer's standard hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled.
- B. Car Control Stations: Provide manufacturer's standard recessed or semi-recessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.
- C. Swing-Return Car Control Stations: Provide car control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.
 1. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
 2. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- D. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

- E. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service as required.
- F. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
 - 1. Include travel direction arrows if not provided in car control station.
- G. Hall Push-Button Stations: Provide one hall push-button station at each landing.
- H. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
 - 1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
- I. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - 1. At manufacturer's option, audible signals may be placed on car.
- J. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 1. Integrate ground-floor hall lanterns with hall position indicators.
- K. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
 - 1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing 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.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: **1/8 inch**, up or down, regardless of load and direction of travel.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with non-shrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance.
 - 3. Mount hall lanterns at a minimum of **72 inches** above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.
- B. Operating Test: Load elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.
- C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. 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.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator.
- B. Check operation of elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.
- C. Check operation of elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 142100

SECTION 211300 - FIRE SUPPRESSION SPRINKLERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. Pipe fittings, valves, connections, and other materials required for a complete system.
- C. System design, engineering, fabrication, installation, and certification.
- D. Fire department connections.

1.02 REFERENCE STANDARDS

- A. ASME B16.1 - Gray Iron Pipe Flanges and Glanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2005.
- B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- C. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- F. NFPA 13R - Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height; National Fire Protection Association; 2010.
- G. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.ca.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation, on stage exposed pipe routes and sprinkler head locations.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
 - 3. Submit shop drawings, product data, and hydraulic calculations to authority having jurisdiction and Fire Marshall for approval.
 - 4. Submit final and authorities' approved shop drawings, product data and hydraulic calculations for Owner's review.
- D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

- E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
 - 2. Sprinkler Wrenches: For each sprinkler type.

1.04 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Designer and Installer Qualifications: Licensed in the state of Georgia and specialized in design and performing the work of this section with at least 5 years' experience in this type of installations.
- C. Designer and Installer Qualifications: Licensed in the state of Georgia and specialized in design and performing the work of this section with at least 5 years' experience in this type of installations.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements, for additional provisions.
- B. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
- C. Provide suitable wrenches for each sprinkler type.
- D. Provide metal storage cabinet.

PART 2 – PRODUCTS

2.01 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Interface system with building control system.

- E. Sprinkler density shall be 0.15 gpm per sq. ft. over 2500 sq. ft. of the most remote area.
- F. Spacing of sprinkler heads shall be 120 sq. ft. per head maximum.
- G. Provide fire department connections.
- H. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.02 SPRINKLERS

- A. Ordinary temperature rating except in locations where temperatures are expected to exceed 100F. Furnish spare heads and wrenches in accord with NFPA 13.
- B. Color and Type of Sprinkler Heads:
 - 1. All sprinkler heads in suspended ceiling areas which are shown on Architectural Reflected Ceiling Plans, including outdoor canopies, shall be concealed type with color to match the adjacent surface, unless otherwise indicated.
 - a. At false beams, provide Series RF II - 5.6 K-Factor Royal Flush II sprinkler heads manufactured by Tyco Fire and Building Products with FM Global approval (no known equal).
 - b. At skylights, provide concealed sidewall head. Do not run piping over skylight glass, to avoid shadows.
 - 2. All sprinkler heads in ceilings that are not shown on Architectural Reflected Ceiling Plans shall be semi-recessed type.
 - 3. All sprinkler heads in exposed structures shall be exposed pendant or upright type, brass color, unless otherwise indicated.
 - 4. All special colors shall be factory coated by the sprinkler head manufacturer.
 - 5. Refer to Architectural Reflected Ceiling Plans and Plumbing Drawings for locations and types of sprinklers.

2.03 ACCEPTABLE MANUFACTURERS

- A. Tyco Fire and Building Products: www.tyco-fire.com
- B. The Viking Corporation: www.vikingcopr.com
- C. The Reliable Automatic Sprinkler Co., Inc.: www.reliablesprinkler.com

2.04 PIPING SPECIALTIES

- A. Buried Piping:
 - 1. Cast Iron Pipe: AWWA C151/A21.51.
 - a. Fittings: AWWA C110, standard thickness.
 - b. Joints: Restrained type, consisting of bolted mechanical joint supplemented with a mechanical joint retainer gland, along with thrust block.
 - c. Mechanical Coupling: Shaped composition sealing gasket, steel bolts, nuts, and washers.
- B. Above Ground Piping:
 - 1. Steel Pipe: ASTM A 53 Schedule 40, black. Schedule 10 pipe is prohibited.

- a. Malleable Iron Fittings: ASME B16.3, threaded fittings.
 - b. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers, galvanized for galvanized pipe.
 - c. Cast Iron Fittings: ASME B16.1, flanges and glanged fittings and ASME B16.4, threaded fittings.
- C. Pipe Hangers and Supports: All pipe hangers and supports shall be UL and FM approved.
- D. Fire Department Connections:
 - 1. Type: Free standing type with ductile iron pedestal red enamel finish.
 - 2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
 - 3. Drain: 3/4 inch automatic drip, outside.
 - 4. Label: "Sprinkler - Fire Department Connection".
- E. Valves:
 - 1. Provide OS&Y gate or butterfly valves.
 - 2. Provide stainless steel chains, by Cableco Model No. 019-3311 for all backflow preventer control valves.
 - 3. Provide tamper switches for all control valves of sub-feed risers.
- F. Water Flow Indicator:
 - 1. Model WFD manufactured by Reliable, or equal by Potter-Roehmer, vane-type water flow detector for all risers, complete with DPDT switch and adjustable retard with FM Global approval for intended use.
- G. Fire Hose System:
 - 1. Pipe and fittings: On systems served from sprinkler system, same as specified for sprinkler system. On systems served from domestic systems, same as specified for domestic system.
 - 2. Fire hose cabinets: Potter-Roemer (basis of design), or equivalent by W.D. Allen or Elkhart.
 - a. Cabinet: Potter-Roemer Model No. 1026, stainless steel.
 - b. Rack: Potter-Roemer Model No. 2710, FM Global-approved, including 1-1/2 inch rough brass 300 lb. UL-listed angle valve, 100 ft. of 1-1/2inch 100 percent synthetic hose (neoprene tube and all Dacron jacket, FM-labeled).
 - 3. Extinguishers: Refer to Section 10 44 00 Fire Protection Specialties.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install sprinkler heads in all spaces, including, but not limited to:
 - 1. Overhangs that are 4 ft. or wider.
 - 2. Combustible concealed spaces.
 - 3. Under platforms.
 - 4. EER, ER, and dimmer rooms.
- C. Install equipment in accordance with manufacturer's instructions.

- D. Provide approved double check valve assembly at sprinkler system water source connection.
- E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.
- F. Place pipe runs to minimize obstruction to other work.
- G. Place piping in concealed spaces above finished ceilings.
- H. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- I. Install and connect to fire pump system in accordance with Section 21 30 00.
- J. Flush entire piping system of foreign matter.
- L. Hydrostatically test entire system.
- M. Require test be witnessed by Fire Marshal, authority having jurisdiction.
- N. Locate heads in guest areas in accord with Architecture Reflected Ceiling Plan (if shown).
- O. Run piping exposed in spaces where construction is exposed or where finish is applied to underside of slab. In rooms with suspended plaster or acoustic tile ceilings, run piping in space above ceiling. Install heads in upright position except where concealed pipe is specified.
- P. Connect kitchen hood to fire sprinkler system with PRV set to 55 psi.
- Q. Connect all fire hose cabinets with a 2 in. pipe from the sprinkler system piping.
- R. In existing spaces with new ceilings, removed all existing piping that interferes with new finishes or other new elements. Install new piping to new sprinkler heads. Make connection to existing system.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 220500 - PLUMBING

PART 1.00 – GENERAL

1.01 SECTION INCLUDES

- A. Plumbing work includes the following principal items:
 - 1. Sewer, drain, soil, waste, and vent piping systems.
 - 2. Storm drain piping systems, including systems for roof drains, overflow drains, downspouts, and planter drains.
 - 3. Domestic and industrial (non-potable) hot and cold water piping systems.
 - 4. Drinking water systems.
 - 5. Fuel gas systems.
 - 6. Connections to air conditioning systems, kitchen equipment, and other equipment specified in other Divisions and Sections.
 - 7. Plumbing fixtures and trim.
 - 8. Other plumbing equipment, including but not necessarily limited to sump pumps, sewage ejectors, water heaters, water pumps, and grease traps.
 - 9. Excavating and backfilling for plumbing work.
 - 10. All permits and permit fees for plumbing work.
 - 11. Cleaning, sterilizing, and testing of plumbing systems.
 - 12. Installation of plumbing trim furnished with kitchen equipment.
 - 13. Demolition, disposition of existing equipment, and sequencing of equipment placing.
 - 14. Backflow preventors.

PART 2.00 – PRODUCTS

2.01 MATERIALS

- A. Refer to applicable system Sections.

PART 3.00 – EXECUTION

3.01 INSTALLATION

- A. Refer to applicable system Sections.

END OF SECTION

SECTION 220510 - PLUMBING BASIC REQUIREMENTS AND METHODS

PART 1.00 - GENERAL

1.01 SECTION INCLUDES

- A. This Section prescribes basic execution methods to be utilized for work of all Sections of Division 22.
- B. Products are generic names followed by specific requirements. References to generic names in other Sections of Division 22 shall be construed to mean the products specified in this Section.
- C. Provisions specified in this section apply to all work of Division 22.

1.02 RELATED REQUIREMENTS

- A. Section 01 77 70 - Closeout Procedures.
- B. Section 01 78 00 - Project Record Documents.
- C. Section 09 90 00 - Paints and Coating.
- D. Section 22 05 48 - Vibration and Seismic Controls for Plumbing, Piping, and Equipment.
- E. Section 22 05 53 - Identification for Plumbing, Piping, and Equipment.
- F. Section 22 07 10 - Plumbing Insulation.
- G. Section 22 10 05 - Plumbing Piping.
- H. Section 22 30 00 - Plumbing Equipment.
- I. Section 22 40 00 - Plumbing Fixtures.

1.03 REFERENCE CODES

- A. FL- Use current editions unless noted otherwise.
 - 1. All local codes; city and/or county as applicable.
 - 2. OSHA requirements.
 - 3. International Building Code, current edition.
 - 4. International Fire Prevention Code, current edition.
 - 5. International Mechanical Code, current edition.
 - 6. International Plumbing Code, current edition.
 - 7. Regulations of all other authorities having jurisdiction.
 - 8. International Energy Efficiency Code, current edition.
 - 9. International Gas Code, current edition.

1.04 REFERENCE STANDARDS

- A. Where equipment, materials, or installations are specified, conform with requirements of current standards of recognized technical or industrial organizations, the label or listing of the specified organization will be acceptable evidence.
- B. The following is the list of acceptable recognized technical or industrial organizations:
 - 1. Air Movement and Control Association (AMCA).
 - 2. American Bearing Manufacturers Association Inc (ABMA)
 - 3. American Gas Associations (AGA).
 - 4. American National Standards Institute (ANSI).
 - 5. American Refrigeration Institute (ARI).
 - 6. American Society for Mechanical Engineers (ASME).
 - 7. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - 8. American Society of Plumbing Engineers (ASPE).
 - 9. American Society of Sanitary Engineering (ASSE)
 - 10. American Society for Testing Materials (ASTM).

11. American Water Works Association (AWWA).
12. Associated Air Balance Council (AABC).
13. Cooling Technology Institute (CTI)
14. FM-Global.
15. Hydraulic Institute Standard (HIS)
16. Institute of Electrical and Electronic Engineers (IEEE)
17. National Air Duct Cleaners Association (NADCA)
18. National Environmental Balancing Bureau (NEBB)
19. National Electrical Code (NEC)
20. National Electrical Manufacturers Association (NEMA).
21. National Fire Protection Association (NFPA).
22. South Coast Air Quality Management District (SCAQMD)
23. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
24. The Hydronics Institute (HI)
25. Underwriters Laboratories (UL).

1.05 SUBMITTAL DATA AND SHOP DRAWINGS

- A. Procedures: In accord with Section 01 30 00 and shall reflect adjustments determined during development of coordinated Drawings.
- B. Submittal materials shall be reviewed for substantial conformity with the intent of the Contract plans and Specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of Contractor which are indicated thereon.
- C. Submit brochures and shop drawings with such promptness as will allow ample time for review and corrections procedures.
 1. Review of submittals will not relieve Contractor of the sole responsibility for correctness of the work.
- D. Product data: Give name or other identification of each item to be provided as part of work of this Contract. Assembled brochures shall show cuts and fully detailed descriptions of manufactured items furnished.
 1. Presentation of brochures shall be in red-colored three-ring binders. Arrange materials in same sequence as Specifications and mark each item in lower right-hand corner with Section, Article, and Paragraph number. Provide separate binder for each section of specification
- E. Shop drawings: Submit shop drawings with detailed descriptions for ductwork and other items which have to be especially fabricated for the project.
- F. Submit equipment layout for any equipment manufactured by other than specified in equipment schedule drawings with the associated ductwork and piping shown to verify adequacy of space for circulation and maintenance.
- G. Scheduled equipment with the indicated capacities, weights, physical dimensions, and electrical characteristics are the basis of design. Equivalent equipment, if specified, may be used; however, any differences between the base of design equipment and equivalent equipment such as weights, physical dimensions, etc., shall be coordinated by Contractor, and any differences which affect the building structural framing or electrical requirements shall be incorporated into the project at no additional cost to Owner.
- H. Submit the following shop drawings and submittals for review:
 1. Plumbing:
 - a. Fixtures
 - b. Trims
 - c. Valves
 - d. Supply pipes and stops
 - e. Pipes and fittings

- f. Pipe support
 - g. Insulation
 - h. Pipe sterilization method
 - i. Backflow protection devices
 - j. Water heating equipment and accessories (heaters, booster heaters, circulating pumps, aquastats, thermometers, storage tanks, T&P valves, etc.)
 - k. Pressure regulators
 - L. Pressure test results
 - M. Compaction test results for underground piping
- I. Refer to individual section for additional requirements on submittals.

1.06 WARRANTY:

- A. See Section 01 77 70 - Closeout Procedures
- B. See Section 01 78 00 - Project Record Documents
- C. The period of all warranties shall commence upon Substantial Completion for the entirety of the Work, regardless of interim use by Contractor or Owner prior to that date and extend it for one year.
- D. Provide additional warranty terms for equipment as indicated in individual section.

1.07 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 7 years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of documented experience and approved by manufacturer.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- D. Refer to individual section for additional requirements on quality assurance.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect material and equipment from damage. Cover fixtures and plated trim to prevent damage from all causes.
- B. Plug and cap piping and ductwork during installation and maintain free from debris and contamination.
- C. Comply with pertinent provisions of Section 01 66 00.
- D. Protect equipment during transit, storage, and handling to prevent damage and deterioration.
- E. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- F. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.
- G. Refer to individual section for additional requirements on delivery, storage, and handling.

1.09 SUBSTITUTIONS

- A. In accord with Section 01 62 00.
- B. Refer to individual section for additional requirements on substitutions.

1.10 EXAMINATION OF DRAWINGS AND PREMISES

- A. Contractor shall visit the Work site, carefully study the Structural, Architectural, Mechanical, Electrical, and other Drawings, and become thoroughly familiar with requirements of the Work and Contract provisions before submitting its proposal. Extra compensation will not be allowed for extra work claims because Contractor failed to follow these directions.

1.11 CODES, PERMITS, FEES, TESTS, AND INSPECTIONS

- A. All work shall comply with requirements of applicable codes, laws, ordinances, and regulations of all authorities having jurisdiction.
- B. Apply for, obtain, and pay costs for all permits for the installation or construction of the work under this Division, and furnish all Drawings required for same.
- C. Arrange and pay for fees, tests, inspections, etc., and furnish signed, certified, and acceptable copies of transactions to Owner.

1.12 RECORD DRAWINGS

- A. Conform to requirements of Section 01 78 00 and the following:
 - 1. Indicate changes of equipment locations and ratings, alterations in ductwork and piping runs and sizes, changes in installation details, control diagrams, and schedules.
 - 2. Use different colors to indicate deletions and additions. Define use of colors.

1.13 OPERATING INSTRUCTIONS

- A. Upon completion of the work, Contractor shall place a competent person in charge, who will operate the system and instruct Owner's personnel in all details of operation and maintenance.
- B. Provide the following for Division 22:
 - 1. Narrative description of each system, describing form, function, components, capacity, controls, and piping color coding.
 - 2. Valve directory with a tag schedule showing location of each valve, type, number, manufacturer, function, and all operating positions.
 - 3. Piping identification charts.
 - 4. Schedule of major components of each system with manufacturer's catalog data, nameplate data, and parts list.
 - 5. Preventative maintenance schedule for each major component of each system.
 - 6. Pressure test reports.
 - 7. Directory: Names, addresses, and telephone numbers of General Contractor, its subcontractors, and related equipment suppliers, including name of person to contact in each case.
 - 8. Provide a separate listing of all components from each manufacturer and from each supplier.
 - 9. Test and balance reports.
 - 10. Specific manufacturer's warranties. List each piece of equipment covered, with day and date warranty begins, date of expiration, and name, address, and telephone number; and name of person to contact regarding problems during warranty period.
 - 11. Listing of extra stock parts such as gaskets, belts, sheaves, and other parts furnished as part of Contract.
 - 12. Sequence of operation as applicable for each system, with flow diagrams, control diagrams, and a chart of all operational positions.
 - a. Start-up position of each system, with indications for position of all controls.
 - b. Shut-down position of each system, with indications for position of all controls.
 - 13. Sequence for troubleshooting operational problems.
 - 14. Copies of installation instructions provided with all control devices.

1.14 COORDINATED DRAWINGS

- A. The trades responsible for the work of this Division shall assist General Contractor in preparing coordinated Drawings in accord with Section 01 30 00.
- B. Coordinated Drawings at ¼ inch per foot minimum scale shall include but not be limited to:
 - 1. Concrete pads and foundations including anchor bolt and sleeve locations.
 - 2. Plans and sections including:
 - a. Support column locations.
 - b. Locations and dimensions for required foundations and pads.

- c. Locations and dimensions of equipment, and service clearances.
- d. Dimensioned floor drain and floor sink locations.
- e. Locations of wall mounted equipment.
- f. Trench locations and sizes.
- g. Sleeve locations in mechanical and equipment rooms.
- h. Electrical raceways and panels.
- 3. Roof layouts including:
 - a. Plumbing and mechanical vents.
- 4. Fire protection systems.

1.15 SERVICE INTERRUPTIONS

- A. Wherever possible, arrange work so that there will be no service interruption of any existing system.
- B. When service interruptions are mandatory, arrange in advance with Owner as to the time and date such interruptions will be permitted.
- C. Put interrupted services back into operation as soon as is practical and in accord with the Owners requirements.
- D. Provide training on operation of chillers, boilers, air handling units, compressor and pumps for owner representative.

1.16 ROUTING OF PIPING

- A. Drawings indicate in diagrammatic form the desired engineering intent. Contractor shall include adequate allowances in its bid to properly perform the work, and shall provide the following:
 - 1. Rerouting, rearrangement, and offsetting of piping to fit the work into available spaces.
 - 2. All openings in non-structural elements, as required for final detailed layout.
 - 3. Coordination and sufficient detailing of all mechanical work to accomplish final installation of all systems in accord with Contract requirements.
 - 4. Coordination with other trades.

PART 2.00 - PRODUCTS

2.01 MATERIALS - GENERAL

- A. All materials shall be new and the best of their respective kinds.
- B. Exposed finish trim, fittings, and pipe in finished rooms or spaces shall be chromium plated brass or be covered with chromium plated brass sleeves. Inside of cabinets exposed to view when doors are open shall be construed to be finished space.
- C. Provide valves with trim as recommended by manufacturer for service on which installed. Use extended 6 inch trim for insulated piping.
- D. Provide same type materials by one manufacturer throughout project.
- E. Standard lists of materials herein may include products not required for this project.

PART 3.00 EXECUTION

3.01 INSTALLATION OF EQUIPMENT:

- A. General
 - 1. It is intended that workmanship be the best standard practice of each trade.
 - 2. Protect equipment from damage from every cause. Exercise particular care to cover/protect equipment during concrete, plaster, and painting operations.
 - 3. Install all floor-mounted or roof-mounted equipment on 6 in. high concrete (housekeeping) pads as indicated on Drawings. Pads shall be sized for footprint of equipment plus minimum of 6 in. in every direction. Check the pad's size for substitute equipment.

- a. Provide all foundation bolts required and coordinate size, shape, and location of pads with concrete trades in Division 3.
 - 4. Install equipment in location and orientation to provide best access and best piping arrangement.
- B. Vibration isolation: See Section 22 05 48.
- C. Access to equipment:
 - 1. Service access: Install equipment in readily accessible locations or provide all means necessary to readily access equipment.
 - a. Equipment will be deemed to be accessible only if all normal maintenance can be performed with ease by an average size person of 160 lb.
 - 2. Service access doors: Furnish metal access doors to wall and ceiling trades for installation where needed to service concealed valves, controls, and other items of mechanical systems.
 - a. Access doors shall be Milcor or equivalent - Style "AT" for acoustical tile, Style "AP" for acoustical plaster, Style "DW" for drywall, Style "MS" for tile wall, and Style "M" elsewhere.
 - b. Unless indicated otherwise on Drawings, provide 24 in. x 24 in. size with concealed hinges, screwdriver actuated cam latch, and factory prime coating, ready for finish painting on the job by the painting trade.
 - c. Provide access doors with UL 1-1/2 hr. label in 1 hour and 2 hr. construction.
 - d. Access doors are not required in removable (accessible) type ceilings.
- D. Electrically-operated equipment:
 - 1. Provide motors and equipment to operate on the electrical characteristics as finally installed in the Work. Review electrical Drawings and Specifications, and verify with electrical engineer and electrical trade as necessary to confirm electrical characteristics before ordering motors and equipment.
 - 2. All motors shall be high efficiency design equivalent to General Electrical Energy Saver Line, and be UL-approved.
 - 3. Provide single phase motors with integral overload protection.
 - 4. Where motors will be exposed to weather, they shall be furnished as weather proof type, UL listed for outdoor service.
- E. Safety guards: Provide metal safety guards to enclose drives for shaft ends and exposed moving parts on running equipment.
- F. Grouting: Grout behind all wall hung plumbing fixtures with hard, white, durable plaster type materials to eliminate all voids and cracks, and to provide sufficient plane bearing surfaces for proper mounting.
- G. Lubrication: Lubricate all bearings in accord with manufacturer's recommendations.

3.02 EQUIPMENT CONNECTIONS

- A. Connect piping to the internally and externally isolated equipment with an approved flexible connector for each piping connection. (Refer to Section 22 05 48)

3.03 INSPECTIONS AND TESTS

- A. Welding inspection:
 - 1. X-ray of welds: Owner intends to make random radiographic examinations of at least 25% of welded joints. If 10% or more of the welds examined are shown to be defective, Owner will make radiographic examinations of 100% of all welds at Contractor's expense. Such inspection shall be performed after normal working hours.
 - 2. Owner will perform radiographic inspection and will choose the welds to be radio graphed and frequency of such inspection each day as the Work progresses.
 - 3. All defective welds shall be repaired in accord with the governing authority. All repaired and/or replaced welds shall be checked by radiographic examination to ensure corrections have been made. All corrections and/or re-examination s shall be paid for by Contractor.

- B. Holiday testing:
 - 1. All wrapped conduit, pipe, fittings and field joints shall be tested on the job site, after assembly, with an approved high voltage holiday detector, signaling device to indicate any flaws, holes, or breaks in the wrapping.
 - 2. All testing will be conducted by Contractor and may be verified by Owner.
 - 3. Where any holidays and any portion of the wrap is damaged or defective, the pipe or conduit shall be prime coated and repaired with no less than two complete wraps of the tape.
 - 4. No wrapped pipe or conduit shall be covered until the testing and necessary repairs have been completed and accepted.
 - 5. Prior to starting the test, all piping shall be completed and placed in the bottom center of the trench on temporary smooth padded blocks which will allow the testing electrode to be run along the underside of the pipe.
 - 6. After all testing and all necessary repairs have been completed, the temporary blocks shall be carefully removed.
- C. Pressure testing:
 - 1. Test all systems in accord with governing codes. Where tests are not specified or required by code, test the system to 1-1/2 times the maximum operating pressure with water for 6 hours with no loss in pressure except changes caused by temperature change. For compressed air and gas systems, air may be substituted as the testing medium.
 - 2. Notify Owner 48 hr. in advance of all tests.

3.04 ADJUSTING AND CLEANING

- A. General: At completion of work, leave entire installation in a neat, clean, and usable condition acceptable to Owner.
- B. Chromium: Polished.
- C. Blow air and fuel gas lines clean with compressed air.
- D. Flush out all water lines with potable water. For heating piping systems, introduce a cleaning solution such as trisodium phosphate during flushing to degrease the system. Dispose of effluent in a manner acceptable to codes. Continue to flush until neutral pH is attained.
- E. After cleaning of system and equipment, carefully adjust all parts of all systems for normal operation.
- F. Storage: Protect piping, valves, and accessories from weather and store them indoors. Maintain piping and valve temperatures higher than the ambient dew-point temperature. If outdoor storage is necessary, support piping and valves off the ground or pavement in dry watertight enclosures.

3.05 PAINTING

- A. Provide all apparatus and equipment with a shop coat at factory. Prepare all insulation for painting.
- B. Thoroughly clean and paint exposed pipe threads on insulated piping with two coats of rust-inhibitive paint.
- C. Except air handling units which are factory painted, provide finish painting of all equipment, apparatus, supports, exposed piping, and insulation. See Section 09 90 00 for additional clarification as applicable.

3.06 TRAINING

- A. Train the Owner's maintenance personnel on start-up and shut-down procedures, trouble-shooting procedures, and servicing and preventative maintenance schedules and procedures.
- B. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel for items listed herein.

- C. Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals specified in Part 1 of this Section and in Division 1.
- D. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.
- E. Provide additional training programs as indicated in individual section.

END OF SECTION

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Inertia bases.
- B. Vibration isolators.
- C. Seismic restraints.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide schedule of vibration isolator type with location and load on each.
- C. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate seismic control measures.
- D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Isolation Technology, Inc; Model : www.isolationtech.com.
- B. Kinetics Noise Control, Inc;
- D. Peabody Noise Control, Inc. (Peabody), Dublin, OH.
- E. M.W. Sausse and Co. (Sausse), Valencia, CA.
- F. Substitutions: Not permitted.

2.02 INERTIA BASES

- A. Structural Bases:
 - 1. Construction: Welded structural steel with gusseted brackets, to support equipment and motor, with motor slide rails.
 - 2. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
- B. Concrete Inertia Bases:
 - 1. Construction: Structural steel channel perimeter frame, with gusseted brackets and anchor bolts, reinforcing; concrete filled.
 - 2. Mass: Minimum of 5 times weight of isolated equipment.
 - 3. Connecting Point: Reinforced to connect isolators and snubbers to base.
 - 4. Concrete: Minimum 3000 psi concrete.

2.03 VIBRATION ISOLATORS

- A. Open Spring Isolators:
 - 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 - 2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- B. Restrained Open Spring Isolators:
 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 4. Restraint: Provide heavy mounting frame and limit stops.
 5. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- C. Closed Spring Isolators:
 1. Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
 4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- D. Restrained Closed Spring Isolators:
 1. Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
 4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- E. Spring Hanger:
 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
 3. Misalignment: Capable of 20 degree hanger rod misalignment.
 4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
- F. Neoprene Pad Isolators:
 1. Rubber or neoprene waffle pads.
 - a. Hardness: 30 durometer.
 - b. Thickness: Minimum 1/2 inch.
 - c. Maximum Loading: 50 psi.
 - d. Rib Height: Maximum 0.7 times width.
 2. Configuration: Single layer.
 3. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.
- G. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.
- H. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.

- I. Seismic Snubbers:
 - 1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
 - 2. Elements: Replaceable neoprene, minimum of 0.75 inch thick with minimum 1/8 inch air gap.
 - 3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
 - 4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Bases:
- C. Rubber
- D. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- E. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- F. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.
- G. Provide seismic snubbers for all equipment, and piping mounted on isolators. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance. Other snubbers shall have clearance between 0.15 inch and 0.25 inch.
- H. Support piping connections to equipment mounted on isolators using isolators or resilient hangers to nearest flexible pipe connector.
 - 1. Up to 4 Inches Pipe Size: First three points of support.
 - 2. 5 to 8 Inches Pipe Size: First four points of support.
 - 3. 10 inches Pipe Size and Over: First six points of support.
 - 4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.02 FIELD QUALITY CONTROL

- A. Inspect isolated equipment after installation and submit report. Include static deflections.

3.03 SCHEDULES

- A. Pipe Isolation Schedule.
 - 1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
 - 2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
 - 3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 GENERAL PROVISIONS

- A. Provisions specified in Section 22 05 10, Plumbing Basic Mechanical Requirements and Methods, apply to all work of Division 22.

1.02 SECTION INCLUDES

- A. Pipe identification.
- B. Equipment identification.
- C. Valve identification.
- D. Pipe Markers.

1.03 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting and Coating: Identification painting.
- B. Section 22 05 10 - Basic Plumbing Requirements and Methods.
- C. Section 22 10 05 - Plumbing Piping.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Brady
- B. Mystic
- C. Seton

2.02 PIPE IDENTIFICATION:

- A. Provide marking tape bands at 50-ft. intervals on all pipe in accessible locations, including spaces above removable ceilings. Provide additional marking tape bands as each pipe enters or exits equipment rooms, and at all equipment connections. Bands shall identify content and direction of flow based on nomenclature on Drawings legend.
- B. Color coding and size of letters and arrows shall conform to ANSI A13.1, "Scheme for the Identification of Piping Systems."
- C. Service marker:
 - 1. Interior: Brady Type B-946 Perma-Code Thin Film Pipe Markers.
 - 2. Exterior: Brady Type B-915 Snap-On, Brady Quik-Applied mechanically affixed with coated wire straps.
- D. Pipe banding tape with directional arrows:
 - 1. Interior: Brady Type B-500 vinyl coated cloth tape or Brady Type B-946 Perma-Code.
 - 2. Exterior: Brady Type B-915 Snap-On.

2.03 EQUIPMENT IDENTIFICATION:

- A. Equipment identification: Mark all equipment with the equipment numbers scheduled on Drawings. Use black phenolic tags with ½ inch high white engraved letters and numbers.
- B. Provide manufacturers name plate for each unit. All name plates shall be visible for owner's inspection.

2.04 VALVE IDENTIFICATION:

- A. Tag all valves with 1-1/2 in. round brass with 1/4 in. engraving of service and valve number.
- B. Provide a typewritten valve list framed behind glass and posted in the mechanical room, indicating valve type, service and tag number.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

- A. Install all identifications in accordance with manufacturer's instructions.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- C. Install tags with corrosion resistant chain.

END OF SECTION

SECTION 220710 - PLUMBING INSULATION

PART 1.00 - GENERAL

1.01 GENERAL PROVISIONS

- A. Provisions specified in Section 22 05 10, Plumbing Basic Mechanical Requirements and Methods, apply to all work of Division 22.

1.02 SECTION INCLUDES

- A. Thermal insulation of piping, fittings, valves, and equipment.

1.03 RELATED REQUIREMENTS

- A. Section 09 90 00 - Paints and Coatings.
- B. Section 22 05 10 - Basic Plumbing Requirements and Methods.
- C. Section 22 10 05 - Plumbing Piping.

PART 2.00 - PRODUCTS

2.01 FIBERGLASS MANUFACTURERS

- A. Owens-Corning
- B. Pittsburgh Corning
- C. Knauf FiberGlass
- D. Manson Insulation Corporation
- E. Johns Manville

2.02 CALCIUM SILICATE MANUFACTURERS

- A. Johns Manville
- B. Owens-Corning

2.03 GENERAL

- A. Provide all materials UL-listed as flame-retardant or non-combustible.
- B. Insulation flame spread rating and smoke development not to exceed 25 and 50.
- C. Provide all exposed pipe insulation with cloth jackets sized in place ready for painting.
- D. Provide concealed pipe insulation with pre sized jackets.

2.04 COLD PIPES

- A. 1-1/2 in. thick, preformed, 5.6 lb. density fiberglass with vapor barrier, with K = 0.23 at 75°F.

2.05 HOT PIPES

- A. 1 in. thick up to and including 2 in. pipe size, 1-1/2 in. thick for 2-1/2 in. pipe size and larger, preformed, 5.6 lb. density fiberglass with K = 0.23 at 75°F.

2.6 TANKS AND HEAT EXCHANGERS

- A. 2 in. thick calcium silicate, 1 in. mesh chicken wire, 1/4 in. thick insulating cement, 8 oz. canvas jacket, and sized ready for painting.

2.7 HOT WATER PUMPS

- A. 1/4 in. thick Virginia No. 312 insulation mastic, 2 in. Foamglas board (removable), and 8 oz. canvas jacket.

2.8 ADHESIVE AND SIZE

- A. Arabol or Benjamin Foster, rodent resistant fire retardant.

PART 3.00 - EXECUTION

3.01 PIPE INSULATION

- A. General: Apply all pipe insulation with rodent-resistant lagging adhesive, Arabol or equal, neatly pasted in place to form a neat workmanlike appearance.
 - 1. All exposed insulation shall have canvas jacket applied and sized in place.
 - 2. Concealed insulation may be pre sized.
- B. Cold pipes: Insulate the following lines as specified for cold pipes:
 - 1. Domestic chilled water piping systems.
- C. Hot pipes: Insulate the following lines as specified for hot pipe systems.
 - 1. Domestic hot water, hot water return and tempered water piping systems, except fixture stubouts.
- D. Storm drainage pipe: Insulate the following lines:
 - 1. Storm drainage piping above grade as indicated in Section 22 10 05.
- E. Dry standpipe: Insulate all dry standpipes that are not contained within stair enclosures as specified for dry standpipe.

3.02 TANK AND HEAT EXCHANGER INSULATION

- A. Insulate all tanks over 100°F operating temperature, and all heat exchangers. Wire calcium silicate blocks in place securely with 14 gauge annealed steel wire. Cover with 1 in. mesh chicken wire and 1/4 in. minimum thickness of plaster. Paste canvas jacket neatly in place and size ready for painting.

3.03 WATER HEATER STACK AND FLUES

- A. Insulate all water heater stacks, flues, breechings, and flue connectors as specified for tanks and heat exchangers.
 - 1. Insulation may be omitted on double wall water heater flues and on water heater flue connectors.

3.04 WEATHERPROOFING

- A. Weatherproof all insulation exposed to outdoor or excessive moisture, and elsewhere as indicated. Install aluminum jacket in accord with manufacturer's instructions.

3.05 PROTECTIVE COVERING

- A. Install aluminum jacket (same as specified for weather protection) on all exposed insulation within 6 ft. of floor or grade, to protect insulation from physical damage.

END OF SECTION

SECTION 221005 - PLUMBING PIPING

PART 1 GENERAL

1.01 GENERAL PROVISIONS

- A. Provisions specified in Section 22 05 10, Plumbing Basic Mechanical Requirements and Methods, apply to all work of Division 22.

1.02 SECTION INCLUDES

- A. This Section prescribes basic materials and execution methods to be utilized for work of all Sections of Division 22.
- B. Products in Part 2.00 of this Section list generic names followed by specific requirements. References to generic names in other Sections of Division 22 shall be construed to mean the products specified in this Section.
- C. Complete piping for:
 - 1. Below grade hot and chilled domestic water piping.
 - 2. Sanitary sewer, waste and vent systems.
 - a. Connections to utilities.
 - b. Waste, vent, and indirect drain from all fixtures and equipment as required for complete operating systems.
 - c. Traps for connections to equipment specified in other Sections.
 - d. Connections to fixtures and equipment furnished by Owner or under other Sections.
 - e. Indirect drain connections to fixtures and equipment furnished by Owner or under other Sections.
 - 3. Potable and non-potable water systems.
 - a. Connections to utilities.
 - b. Domestic and industrial (non-potable) water supply to all fixtures and equipment as required for complete operating systems.
 - c. Insulation as specified.
 - d. Sterilization of potable water systems.
 - e. Stops, supplies, and accessories for connections to equipment specified in other Sections.
 - f. Connections to all fixtures and equipment furnished by Owner or under other Sections.
 - 4. Natural gas
 - a. Connections to utilities.
 - b. Gas piping for plumbing, air conditioning, kitchen, and other equipment as indicated on Drawings or specified.

1.03 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting and Coating.
- B. Section 22 05 10 - Basic Plumbing Requirements and Methods.
- C. Section 22 05 16 (15122) - Expansion Fittings and Loops for Plumbing Piping.
- D. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- E. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- F. Section 22 07 10 - Plumbing Insulation.

PART 2 PRODUCTS

2.01 HOT WATER PIPING, BELOW GRADE

- A. Manufacturer:
 - 1. Perma Pipe
 - 2. Thermacor

3. Thermal Pipe Systems

- B. Xtru-therm as manufactured by Perma Pipe/ Ric-Wil prefabricated and pre insulated piping system composed of straight sections only. Fittings, anchors and other accessories shall be factory-fabricated to job dimensions and designed to minimize the number of field welds, composed of integral sealed HDPE outer jacket, polyurethane foam insulation and steel carrier pipe, as herein specified. Each system layout shall be computer analyzed by the piping system manufacturer to determine stress on the carrier pipe and anticipated thermal movement of the service pipe. The system design shall be in strict conformance with ANSI B-31.1 latest edition.
1. Outer jacket: High density polyethylene (HDPE) compound, per ASTM D1248, Type 3, Class C.
 2. Insulation: Polyurethane foam with the following minimum characteristics: K Factor 0.14 Blue/hr. per sq ft. per F per in. at 73 degrees F. Density 2 pcf, closed cell - 90-95% in conformance with MIL-1-24172 and ASTM C591 completely filling the annular space between carrier pipe and jacketing. Minimum insulation shall be in accord with Table 1. Exposed insulation at unit ends shall be sealed with a factory applied vapor barrier.
 - a. To ensure no voids are present, all insulation shall be infrared inspected.
 - b. Visually checked prior to application of the protective jacket.
 3. Carrier Pipe: Internal piping shall be copper type K with silver brazed joints.
 4. Fittings: Fittings will conform to pipe type and will be silver brazed for pressure piping to straight lengths in pre- plant.
 5. Insulation of connector joints: After welding and testing, joints shall be insulated with insulation and jacketing materials furnished by manufacturer. The installer shall seal the field joint area with a heat shrinkable adhesive backed sleeve. Backfilling shall not begin until the heat shrink sleeve has cooled.
 6. Anchors: 1/4 in. thick steel plate prefabricated anchor is attached to internal pipe and sealed to pipe jacketing at locations shown on drawings.
 7. End seals: Manufacturers wishing to have their products approved as an equal on the project shall comply with the following: Supply to Engineer at submittal time, a letter of certification from an independent testing laboratory that their products have been tested approval under the following test criteria:
 - a. Casing and end seal testing and certification: Test and certification procedures shall demonstrate that casing and end seals are capable of resisting penetration of water into casing and insulation at 20 feet of head pressure, measured above the highest point of the test sample, subjected over the entire surface of 8 foot casing test sample for not less than 24 hours.

Nominal Pipe Size (in.)	Minimal Insulation Thickness (in)	Jacket size (in.)
1	1.345	4HDPE
1-1/4	1.17	4HDPE
1-1/2	1.05	4HDPE
2	1.81	6HDPE

- C. Provide steel sleeve for piping below or through footings of adequate size to accommodate the pre insulated conduit.
- D. Provide Link-Seal wall sleeves for penetration of water-sealed underground walls.

2.03 WASTE AND VENT PIPING, FITTINGS, AND TRAPS FROM FLOOR SINKS AND DRAINS RECEIVING BEVERAGE (CO2) WASTE

- A. Corrosion-resistant, flame-retardant polypropylene with thermal fusion system.

2.04 WASTE PIPING

- A. Above grade: Schedule 40 PVC.
- B. Below grade:

1. Inside and outside of building: Schedule 40 PVC.
- C. Piping from floor sinks and floor drains receiving waste carbonated beverage:
 1. Schedule 40 PVC.

2.05 VENT PIPING

- A. Above grade: Either of the following:
 1. Schedule 40 PVC.
- B. Below grade: Schedule 40 PVC.
- C. Piping from floor sinks and floor drains receiving waste carbonated beverage:
 1. Schedule 40 PVC.

2.06 INDIRECT DRAIN PIPING

- A. Schedule 40 PVC.

2.07 PUMP DISCHARGE (FORCED) PIPING

- A. Galvanized steel pipe and fittings.

2.08 STORM DRAIN PIPING

- A. Above grade: Service weight cast iron soil pipe and fittings.
- B. Below grade:
 1. Inside and outside of building: Service weight cast iron soil pipe and fittings.

2.09 WATER PIPING

- A. Above grade:
 1. CPVC Piping.
- B. Below grade:
 1. CPVC Piping.

2.10 GREASE DUCT AND HOOD WASHDOWN PIPING

- A. Type "K" (for underground) or Type "L" (for above ground) hard copper with soldered fittings and silver soldered joints. Do not use Type "M".
- B. For grease duct and hood washdown piping, use Type L hard copper with soldered fitting and soldered joints for outside grease duct enclosure and grease hood, and use Type 316 Schedule 40 stainless steel pipe/tube with Swagelok fitting inside grease duct.

2.11 FUEL (NATURAL) GAS PIPING

- A. Above grade: Schedule 40 black steel with welded joints and fittings
- B. Below grade: Factory coated schedule 40 black steel with wrapped welded joints and fittings

2.12 VALVES

- A. Shut off valves:
 1. Smaller than 4": Ball valves
 2. 4" and larger: Gate valve
- B. Throttling valves: Globe valves.

2.13 CONDUITS FOR REFRIGERANT, SYRUP AND CO2 PIPING

- A. Schedule 40 PVC conduit with PVC socket couplings, long sweep conduit bends, and solvent welded joints.
- B. Galvanized steel pull boxes with screwed-on covers.

2.14 PIPE HANGERS AND SUPPORTS

- A. General: Hangers and maximum hanger spacing shall conform to the following:
 1. Maximum Spacing Between hangers:

Pipe	Rod	Cast Iron	All Other	Metal Pipes	PVC/CPVC
Size	Size	Pipe	Horizontal	Vertical	Horizontal
3/4	3/8	-	6 ft.	10 ft.	3. ft.
1	3/8	-	6 ft.	10 ft.	3. ft.
1-1/4	3/8	-	6 ft.	One Story	4. ft.
1-1/2	3/8	-	6 ft.	One Story	4. ft.
2	3/8	5 ft.	10 ft.	One Story	4. ft.
2-1/2	1/2	-	10 ft.	One Story	4. ft.
3	1/2	5 ft.	10 ft.	One Story	4. ft.

- B. Beam attachments: painted finish; B-Line Figure B3050, or Owner-approved equivalent by Secure Strut & Hanger Co. or Unistrut.
- C. Clevis hangers:
 - 1. Standard hanger for steel pipe: Painted finish B-Line Figure, or Owner-approved equivalent by Secure Strut & Hanger Co., Tolco or Unistrut.
 - 2. For copper pipe: Electro-galvanized plastic coated; B-Line Figure B3100C, or Owner-approved equivalent by Secure Strut & Hanger Co., Tolco or Unistrut.
 - 3. AWWA type for iron pipe; painted finish; B-Line Figure B3102, or Owner-approved equivalent by Secure Strut & Hanger Co., Tolco or Unistrut.
- D. Protection Shields:
 - 1. Insulated pipe: Thermal hanger shield: 360 degree insert of calcium silicate totally encased in sheet metal shield; pipe shields Model A2000 (chilled water) or A3000 (other lines), or equivalent by Uni-Grip on Insul-shield.
 - 2. Bare pipe: Felt isolator; B-Line figure B3195, or approved equivalent by Secure Strut & Hanger Co. or Unistrut.
- E. Sleeves and flashings:
 - 1. Exterior wall: Wade 3600 or Owner-approved equivalent by Link Seal.
 - 2. Interior wall: Pipe shields Model WFB-CS, or Owner-approved equivalent by Pipe Shields Inc.
 - 3. Waterproofed floor: Wade W-3600.
 - 4. Floors: Pipe shields Model DFB-CS or QDFB-CS.
 - 5. Furnish materials and coordinate installation for flashing and counter flashing roof penetrations for vents, pipe, drains, and ducts.
 - 6. Materials:
 - a. Sheet metal : 24 gauge minimum ASTM 525, Class G90.
 - b. Sheet lead: 4 pounds per square foot.
 - c. Stainless steel: Minimum 24 gauge.
 - d. Sheet copper: 16 oz. per square foot.
 - e. Vent stack fitting: Josam1830 or Jay R. Smith 1750.

2.15 MATERIALS - GENERAL

- A. All materials shall be new and the best of their respective kinds.
- B. Exposed finish trim, fittings, and pipe in finished rooms or spaces shall be chromium plated brass or be covered with chromium plated brass sleeves. Inside of cabinets exposed to view when doors are open shall be construed to be finished space.
- C. Provide valves with trim as recommended by manufacturer for service on which installed.
- D. Provide same type materials by one manufacturer throughout project.
- E. Standard lists of materials herein may include products not required for this project.

2.16 PIPE AND TUBE

- A. Steel pipe:

1. ASTM A53 Grade B, seamless or electric resistance weld; ASTM A106 Grade B; or ASTM A120.
 2. Black or galvanized as specified.
 3. Beveled ends (B.E.), grooved (G.), or threaded and coupled (T&C), as specified in the applicable Division 22 Sections.
- B. Cast iron soil pipe: In accord with current issue of standards of the Cast Iron Soil Pipe Institute. Bitumastic-coated.
1. Hub and spigot or No-Hub.
 2. Service weight.
- C. Polypropylene pipe: Flame-retardant polypropylene with thermal fusion system for joints; GSR FUSEAL or equivalent by Spirolite.
- D. Copper tube: ASTM B88, 20-ft. straight lengths, except provide soft temper in 60-ft. coils for underground work.
1. Type "K" except where Type "L" is specified.
 2. Hard temper except where soft temper is specified.
- E. Ductile iron: Bell and spigot, mechanical joint, ductile iron, cement lined, with neoprene gasket and galvanized bolts, Class 50, ANSI A21.51 and ANSI A21.4 bituminous exterior coating.
- F. Stainless steel pipe: 304 stainless steel seamless, fully annealed, ASTM A269 or A213 with threaded fittings.
- G. PVC pipe: Sch 40 and Sch 80 Type I, 160 psi at 73 deg. F, ASTM 1785 with solvent cement fittings. Solvent cement and purple cleaner shall be supplied by same manufacturer.
- H. CPVC pipe: Sch. 40 and Sch. 80, 230 psi at 73 deg. F, ASTM F441, with solvent cement fittings. Solvent cement and purple cleaner shall be supplied by same manufacturer.

2.17 FITTINGS

- A. Malleable iron fittings: Screwed, banded pattern, ASTM A197 and ANSI B16.3 - Crane, or equivalent by Walworth, Grinnel, or Stockham.
1. Standard 150 lb. or extra heavy 300 lb. as specified.
 2. Black or galvanized as specified.
- B. Malleable iron unions: Screwed, - Crane, or equivalent by Walworth, Grinnel, or Stockham.
1. Standard 150 lb. or extra heavy 300 lb. as specified for fittings.
 2. Black or galvanized as specified.
 3. Provide dielectric unions where connecting pipe of dissimilar metals.
- C. Cast iron fittings: Screwed - Crane, or equivalent by Walworth, Grinnel, or Stockham.
1. Standard 125 lb. or extra heavy 250 lb. as specified.
 2. Black unless galvanized is specified.
- D. Screwed flanges: Cast iron or steel, raised face - Crane, or equivalent by Walworth, Grinnel, Stockham, Tube Turn, Ladish, or Taylor Forge.
1. Where steel is specified, use only steel.
 2. Standard cast iron 125 lb. or steel 150 lb. Extra heavy cast iron 250 lb. or steel 300 lb. as specified for fittings.
 3. Cast iron plain, steel black enamel, unless specified as galvanized.
 4. Drilling to match mating flange on valve or equipment.
- E. Welding flanges: Steel, weld neck or slip on, black enamel, raised face - Tube Turn, or equivalent by Ladish or Taylor Forge.
1. Standard 150 lb. or extra heavy 300 lb. as specified for fittings.
 2. Drilling to match mating flange on valve or equipment.
 3. Slip on flanges shall be welded inside with at least one pass in addition to full fillet weld outside.
- F. Flange gaskets: 1/8 in. thick, composition, unless specified otherwise - Garlock, or equivalent by Crane. Asbestos type gaskets are not approved.

- G. Flange bolting materials: Carbon steel heavy hex bolts and nuts, ASTM A307, Type B.
- H. Welding fittings: Factory-formed, steel plate or steel tube, beveled end, prime coat or enameled - Tube Turn, or equivalent by Ladish or Taylor Forge.
 - 1. 2 in. and smaller: 3000 lb., forged steel, socket weld, ASTM A105, Grade 2, and ANSI B16.11.
 - 2. 2-1/2 in. and larger: Seamless steel, full pattern, long radius, butt weld, ASTM A234 and ANSI B16.9.
- I. Cast iron soil pipe fittings: In accord with current issue of Standards of the Cast Iron Soil Pipe Institute. Bitumastic-coated.
 - 1. Hub and spigot or No-Hub.
 - 2. Service weight.
 - 3. No-Hub couplings:
 - a. Cast iron mechanical (MG) couplings, installed with torque wrench to 175 in. lb.
 - b. Stainless steel band type No-Hub couplings equal to Clamp All XXHD type may be used above grade only.
 - c. Hub gaskets: Neoprene Double "O" ring type equal to American Foundry "Dual Tite."
- J. Polypropylene fittings: Flame-retardant polypropylene with thermal fusion system for joints; GSR FUSEAL or equivalent by Spirolite.
- K. Solder fittings: Cast brass or wrought copper ANSI B16.22 solder joint type - Nibco, or equivalent by Grinnel. Cast bronze fittings ANSI B116.18 may be used only in sizes not manufactured in wrought copper.
- L. Ductile Iron fittings: Ductile iron, cement lined, AWWA Class 250, ANSI A21.10, bell and spigot; mechanical restrained joint with neoprene gaskets and galvanized bolts, MegaLug or equivalent by US Pipe or American.
- M. Grooved couplings: Mechanical couplings requiring a machined groove on pipe with suitable gaskets for service on which installed - Victaulic, or equivalent by Gruvlok.
- N. Stainless steel pipe fittings: Fittings shall be threaded type ASTM A269 or A213.

2.18 VALVES

- A. Quality Assurance
 - 1. Boiler valves: ASME Boiler Code Specifications.
 - 2. Valve bodies, shells, and seats: Factory tested.
 - 3. Bronze body valves:
 - a. Materials for pressure containing parts: ASTM B-62 (less than 200 psi), B-61 (200 psi and above).
 - b. Design, workmanship, testing: MSS-SP-80.
 - 4. Iron body valves:
 - a. Materials for pressure containing parts: ASTM A126, Grade B.
 - b. Face-to-face and end-to-end dimensions: ANSI B16.10.
 - c. Design, workmanship, testing: MSS-SP-70, 71.
 - 5. Butterfly valves:
 - a. Face-to-face and end-to-end dimensions: MSS-SP-67.
 - 6. Valve stems: ASTM B584, Class 13C (cast silicon brass).
 - 7. Pressure castings: Free of impregnating materials.
 - 8. Valve name or trademark and working pressure stamped or cast into body.
 - 9. Standard for 200 psi and 300 psi valves with metallic seats: ASTM B61.
- B. Gate valves:
 - 1. Class 125/150 WOG:
 - a. Threaded or solder ends: Class 150; bronze; screw-in bonnet; non-rising stem; resilient wedge; NIBCO T-113 or S-113, or Owner-approved equivalent by Crane, Stockham, or Jenkins.

- b. Flanged ends: Class 125; iron body; bolted bonnet; non-rising stem; resilient wedge; bronze mounted; NIBCO F-619, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - 2. Class 300 WOG:
 - a. Threaded ends: Class 300; bronze block pattern; union bonnet; non-rising stem; alloy solid wedge; NIBCO T-176-SS, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - b. Flanged ends: Class 300; cast steel; raised face flanges; bolted bonnet; outside screw and yoke; flexible wedge; universal trim.
- C. AWWA gate valves:
 - 1. 2-1/2 in. and smaller: 200 psi; iron body; bronze mounted; non-rising stem; flanged type; O-ring seal; 2 in. square wrench nut; Clow 6100, or Owner-approved equivalent by Mueller.
 - 2. 3 in. and larger: 200 psi; iron body; bronze mounted; resilient wedge; non-rising stem; mechanical joint type; O-ring seal; 2 in. square wrench nut; set screw locking gland; Clow 6100, or Owner-approved equivalent by Mueller.
 - 3. Provide extension stem to 6 in below final grade and valve box. Valve box shall be cast iron; two-piece; buffalo type; 5-1/4 in. shaft; screw type; with lid marked "water"; by Alhambra or Bingham & Taylor.
- D. OS&Y gate valves:
 - 1. Above grade: Flanged, 175 lb. iron body; bolted bonnet; outside screw and yoke; solid wedge; NIBCO F-607-0, or Owner-approved equivalent by Kennedy or Mueller.
 - 2. Below grade: Mechanical joint, 175 lb. iron body; bolted bonnet; indicator post pattern with non-rising stem; solid wedge; NIBCO M-609, or Owner-approved equivalent by Kennedy or Mueller.
 - 3. Valves shall be UL-listed and FM-approved.
- E. Globe valves:
 - 1. Class 125/150 WOG:
 - a. Threaded or solder ends: Class 150; bronze; screw-in bonnet; integral seat; renewable discs; NIBCO T-211 or S-211, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - b. Flanged ends: Class 125; iron body; bolted bonnet; renewable seat and disc; bronze mounted; NIBCO F-718-B, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - 2. Class 300 WOG:
 - a. Threaded ends: Class 300; bronze; union bonnet; integral seat; renewable discs; NIBCO T-275, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - b. Flanged ends: Class 250; cast steel; raised face flanges; bolted bonnet; outside screw and yoke; universal trim.
- F. Check valves:
 - 1. Class 125/150 (swing type):
 - a. Threaded or solder ends: Class 125; bronze; horizontal swing; regrinding type; Y-pattern; renewable discs; NIBCO T-413 or S-413, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - b. Flanged ends: Class 125; iron body; bolted bonnet; horizontal swing; renewable seat and disc; NIBCO F-918, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - 2. Class 300 WOG (swing type):
 - a. Threaded ends: Class 300; bronze; horizontal swing, regrinding type; Y-pattern; renewable discs; NIBCO T-473, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - b. Flanged ends: Class 300; cast steel; raised face flanges; bolted bonnet; outside screw and yoke; universal trim.
 - 3. Class 125 WOG (non-slam):

- a. Wafer type: Class 125; cast iron; double door; resilient seated; spring closing; Apco series 9000, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
 - 4. Class 250 WOG (non-slam):
 - a. Wafer type: Class 250; cast iron; double door; resilient seated; spring closing; Apco series 9000, or Owner-approved equivalent by Crane, Stockham, or Jenkins.
- G. Gas cocks:
 - 1. Medium and high pressure: 200 CWP; iron plug valve; two-bolt cover; short pattern; wrench operated; 2 in. and smaller, Rockwell Nordstrom Figure 142 (threaded ends); 2-1/2 in. and larger, Figure 143 (flanged ends).
 - 2. Low pressure: 2 in. and smaller, 125 psi, bronze cock, square head, Crane No. 250; 2-1/2 in. and larger, same as medium and high pressure.
- H. Butterfly valves: 200 psi; ductile iron body; geometric drive; molded-in seat liner, lug type; NIBCO LD-2010-3 or Owner-approved equivalent by Crane or Grinnell (2 in. to 6 in.), NIBCO LD-2000-5, or Owner-approved equivalent by Crane or Grinnell (for 8 in. to 12 in.); 150 psi; ductile iron body, gear drive, molded-in seat liner, lug type, NIBCO LD-0010-5, or Owner-approved equivalent by Crane or Grinnell (for 14 in. to 16 in.).
- I. Balancing cocks: Same as specified for low pressure gas cocks.
- J. Balancing valves:
 - 1. Provide calibrated non-ferrous valve with differential pressure taps for meter connections including built-in screwed and cast iron flanges check valves and stainless steel strainer.
 - 2. Preset flow control valve: Provide with stainless steel flow control cartridge which can be removed and replaced without breaking piping connections.
 - 3. Manual flow control valve: Include integral pointer indicating valve opening position with a tamper-proof memory feature, venturi type.
 - 4. Manufacturers: Griswold, Armstrong, Bell & Gossett, Taco.
- K. Ball valves (except for compressed air):
 - 1. Class 125/300 WOG:
 - a. 2 in. and smaller: Threaded or solder ends; 125 psi; two-piece bronze body; conventional port; bronze trim; blowout proof stem; Teflon seats and seals; NIBCO T-580 or S-580, or Owner-approved equivalent by Crane, Grinnell, or Apollo.

PART 3 EXECUTION

3.01 INSTALLATION

- B. It is intended that workmanship be the best standard practice of each trade.
- C. Run piping parallel to building construction.
- D. Unless detailed otherwise or specifically approved in writing by Owner, conceal all piping in walls, partitions, ceilings or furred spaces.
- E. Properly support all equipment and piping from main structural members. Provide secondary structural framing as required. Do not hang equipment or piping directly from slabs or decks.
- F. Properly pitch all piping for proper drainage.
- G. Isolate all piping from building structure.
- H. Where exterior watering piping is required, pipe shall be insulated and have metal insulation jacket.
- I. Properly wrap all copper and steel pipe and fittings below grade.
- J. Make up connections between piping of dissimilar metals with approved dielectric couplings.
- K. Do not permanently close-up, furr-in, or cover-over completed piping runs until they have been inspected and approved.
- L. Install exposed polished or enamel trim connections at fixtures with special care free from tool marks and exposed threads at fittings.

- M. Use reducing/increasing fittings where a change in pipe size occurs in a run.
- N. Bushings of any type are not permitted, except for insertion of the thermometers or gauges.
- O. Unless specifically specified or detailed otherwise, only cast iron soil pipe will be permitted be run beneath floor slabs on grade.
- P. Clean inside of pipe before installing it. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.
- Q. Install pipe so that it does not interfere with the opening of doors or apparatus, access to equipment, or to electrical equipment.
- R. Do not install pipes in such a way that they will appear torque to pumps. After pumps have been installed, and pumps have been operated, recheck and realign pumps if necessary.
- S. Do not install water pipes through electrical rooms, power electronic rooms, electrical equipment rooms, tele/data rooms, , or audio/visual rooms.
- T. Do not install piping above electrical equipment, such as starters, variable frequency drives, motor control centers, or disconnects.
- U. Provide flanges and unions throughout the pipe systems at all equipment. Make provisions for servicing and removal of equipment without dismantling piping.
- V. Piping passing through or under grade beams or through foundation walls shall be provided with a schedule 40 steel pipe sleeve two sizes greater than the pipes passing through the sleeves.
- W. Steel pipe, screwed: Cut threads straight and true and properly ream burrs for free-flow. Apply Crane Thread Lubricant, Grinnel Figure 1698 or WKM "Key-Tite." Leave not more than two threads exposed after joints are made up.
- X. All gas piping shall be connected to equipment and fixtures with FM approved flexible connectors.
- Y. Steel pipe, welded:
 - 1. Make continuous welds with electric arc process in accord with recommendations of ASTM Section IX for welder's qualifications and the applicable sections of ANSI B31 for type of service.
 - 2. Properly bevel and clean joints before making welds.
 - 3. All welds shall be made by a qualified welder.
 - 4. Use factory-formed fittings or Weld-O-Lets for all changes in direction and branch connections.
- Z. Steel and cast iron pipe, mechanical and/or gasketed joints: All piping joints shall be groove couplings, gasketed bell and spigot joints. No-Hub soil pipe band joints, or other mechanical joints shall be made up in accord with manufacturer's recommendations.
- AA. Plastic pipe:
 - 1. All plastic pipe shall be joined with proper fittings. Solvent or fusion weld to pipe in accord with manufacturer's recommendations.
- AB. Copper Tube:
 - 1. Make all connections and changes of direction with factory fittings, except that tubing may be bent to a radius not less than three times the pipe diameter provided that bends are made using proper bending tools and no appreciable flattening or distortion of tube results.
 - 2. Cut tube with a tubing cutter. Ream and clean ends to a bright finish. Clean inside of fitting sockets to a bright finish.
 - 3. Make-up solder joints with appropriate paste flux and solder with 95/5 solder, unless specified otherwise.
 - 4. Make-up silver solder (brazed) joints with appropriate flux and silver solder with silver brazing alloy.
- AC. Valves
 - 1. Install shut off valves on all except waste and vent, in the following locations:
 - a. Mains entering or leaving building.

- b. All Major branch runs such as branches serving a floor, a wing, or a major section of a building.
 - c. All equipment connections.
 - d. Other locations as may be indicated on Drawings.
 - 2. Install balancing valves as indicated on Drawings and as required for proper balancing of the various systems.
 - 3. All valves shall be line size.
- AD. Strainers, air vents, and valved drains:
- 1. Strainers: Install strainers at the inlet of all pumps, automatic valves, pressure regulators, steam traps and as may be indicated on Drawings..
 - 2. Air vents: Install air vents at high points of all steam and water piping systems as required for proper system operation, and at any other locations as may be indicated on Drawings.
- AE. Valved drains: Install valved drains at low points in piping runs as required for complete system drainage, at all strainer blow-off connections, at at other locations as may be indicated on Drawings.
- 1. Provide valved drains at all equipment that is not otherwise self-draining through the piping system.
- AF. Unions: Install unions at all equipment connections, on both sides of all automatic views, at steam traps, at regulator and at other locations as may be indicated on Drawings. Flanges or reassemble able mechanical joints may be substituted for unions where these types of joints are otherwise permitted.
- AG. Drain Pans: Provide 16 gauge galvanized sheet metal drain pans below pipes conducting liquids of any kind as indicated on Drawings.
- 1. Pane shall be 2 1/2 in. deep and reinforced with angle iron frame. Support and brace pans as required.
 - 2. Run 3/4 in. copper drain to waste receptor.
- AH. Underground pipe system coating
- 1. Protect all underground copper and steel piping as follows, unless specified otherwise; and other foreign materials. All sharp points shall be removed.
 - a. Use Hexane, Toluol, Toluene, Xylol. Do not use oil-based solvents for cleaning.
 - b. Priming: Use JM No. 22 primer to obtain the maximum coating bond to pipe and also to act as a filter for flawed coating surfaces.
 - 2. Coating application:
 - a. Mechanically spirally apply tape wrap. The overlap of each spiral layer shall be a minimum of 1/2 the width of he tape used.
 - b. Field joints - tees and fittings: Hand wrap field joints over clean surfaces with tape wrapping extending from 2 in to 6 in over existing pipe coating, depending on the pipe diameter.
 - c. Testing of coated pipe: User approved holiday detector and test the coating integrity of all piping system. Set test voltage at 7500V.
 - 1) Repair all "leaks" in manner as specified for original coating.
 - 3. Corrosion protection: All buried uncoated and/or otherwise unprotected valves, clamps, flanges, bolts, nuts, etc. shall be cleaned, primed, and coated with epoxy mastic equivalent to Carboline 890 or Carbomastic 15 Low Odor. Apply in accord with manufacturer's instructions.
- AI. Sleeves and escutcheons:.
- 1. Sleeves:
 - a. Provide sleeves for all pipes passing through floors, walls and ceilings. Extend sleeves 2 in. above floors. Make sleeves flush with walls and ceilings.
 - b. At concrete construction, set sleeves, or Owner-approved equivalent, for penetration of underground walls.
 - c. Provide Link Seal wall sleeves, or Owner-approved equivalent, for penetration of underground walls.

- 1) Escutcheons: Provide chrome-plated hinged escutcheon with set screws at each exposed pipe passing through a wall, floor, or ceiling in finished portions of the building.
- 2) Escutcheons Shall be Beacon or equal No. 13 for pipe sizes through 6in. and Beacon or equal No. 3 for pipe sizes larger than 6 in. Where piping insulated, escutcheons shall fit around outside of insulation.

AJ. Openings:

1. Except where specifically indicated on Drawings, openings for piping for equipment will not be allowed in any structural members without written consent of Owner. For openings through concrete construction, install sleeves in forms before concrete is placed.
2. In the event additional openings are required through structural members, or notching, boring or cutting of the structure is necessary, perform the work as directed in writing by Owner.
3. Include all costs for cutting of holes required for installation of work.

AK. Waterproofing: Make absolutely watertight all openings through waterproofed construction caused by the penetration of mechanical work.

AL. Thrust / support blocks: Provide thrust blocks at vertical and horizontal underground pipe locations, such as branch tees, directional changes, and where required to prevent the separation of mechanical type pipe joints in accord with recommendations of AWWA and DIPRA (Ductile Iron Pipe Research Association).

AM. Pipe detection tracing:

1. Provide wire tracing for all underground non-metallic piping systems.
2. Copper tracer wire shall be #14 AWG solid, single conductor, insulated copper wire. Place in pipe trench above the pipe at maximum depth of 3ft. Do not secure to the pipe.
3. Terminate at each building near pipe entrance. Rise through conduit to weatherproof junction box mounted on building wall. Label box "Tracer Wire" with name of service.

AN. Sterilizing potable water systems

1. Notify Water Department and Owner 24 hr. in advance of pressure testing or chlorination.
2. Sterilize (chlorinate) all new potable water systems and portions of existing systems subjected to contamination during major renovations.
 - a. Use potable water for all testing.
 - b. Provide all equipment and materials required for the chlorination and testing.
 - c. Provide suitable connections for injection of the chlorine solution.
 - d. Provide adequate flush points for flushing and chlorination.
 - e. Thoroughly flush the system before chlorination.
 - f. Chlorinate to a 50 ppm chlorine residual, and hold the residual in the system for 24 hours.
 - g. After the 24-hr. contact time and upon authorization from Water Department and Owner, flush system to water supply chlorine residual.
 - h. Water Department and/or Owner will draw samples and obtain bacteriological analysis. Should samples prove unsatisfactory, repeat chlorination procedure.
 - i. Water Department, upon satisfactory completion of chlorination, will turn on water in presence of Contractor.

AO. Below ground piping installation: In accord with manufacturer's recommendations

AP. All branch take-offs shall be from the top of water main run.

3.02 SERVICE CONNECTIONS

- A. Provide proper adapter where size and/or material of site utility is different at point of connection.
- B. Provide all required pipe offsets in direction and elevation to properly connect to utility mains at point of connection.
- C. Make connections to utility mains as indicated and as required for a complete operating system, including all concrete cutting and patching.

3.03 SEISMIC BRACING AND ANCHORAGE

- A. Seismic bracing and anchorage of piping shall be done in accord with "Guidelines for Seismic Restraining of Mechanical Systems," latest edition, published by SMACNA, and in compliance with local codes.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 GENERAL PROVISIONS

- A. Provisions specified in Section 22 05 10, Plumbing Basic Mechanical Requirements and Methods, apply to all work of Division 22.

1.02 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Electric water coolers.
- F. Drinking fountains.
- G. Showers.

1.03 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealers: Seal fixtures to walls and floors.
- B. Section 22 05 10 - Basic Plumbing Requirements and Methods.
- D. Section 22 10 05 - Plumbing Piping.

1.04 REFERENCE STANDARDS

- A. ANSI Z124.2 - American National Standard for Plastic Shower Units; 1995.
- B. ANSI Z124.1.2 - American National Standard for Plastic Bathtub and Shower Units; 2005.
- C. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2004.
- D. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration Systems; 2006.
- E. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 2002.
- F. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).
- G. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.
- H. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).
- I. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2008.
- J. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2008.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 PLUMBING FIXTURES

- A. See Construction Documents.

2.02 CARRIERS AND BACKING

- A. Carriers: Wade, Zurn, or Smith of type suitable for proper fixture installation.
- B. Backing: 1/4 in. x 6 in. steel plate set horizontally and firmly attached to three studs minimum for backing at all wall hung fixtures and accessories except where carriers are specified.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount fixtures at heights indicated on Architectural Drawings.
- B. At sinks, lavatories, and other pairs of faucets, install the cold water faucet on the right side, and install the hot water faucet on the left side.
- C. Where sinks and lavatories are specified to be mounted in countertops, closely coordinate the work of this Section with that of the other trade Sections affected for correct cutting of countertops and backsplashes to receive plumbing fixtures and trim.
- D. Securely fasten all carriers to floor construction to prevent overturning.
- E. Use fittings with fastening ears to anchor water piping to structure at fixture locations.
- F. Smoothly grout joints between fixtures and floor or wall with G.E. Silicone Grout No. 1702.
- G. Insulate exposed water supply and drain piping on all handicap lavatories with series 100 white Handi Lav-Guard insulation kit by Truebro Inc., Ellington CT, or Owner-approved equivalent by Plumber Specialty Products, Inc.
- H. Provide plumbing fixtures, trim and related items such as supplies, traps, drains, cleanouts, water closet flanges, bolts, seats and covers, fixture supports and other accessory items.
- I. Coordinate fixture requirements by reviewing architectural, structural, and equipment drawings. Install fixtures in accordance with Contract Drawings and manufacturer's rough-in drawings. Coordinate dimensions required for minimum fixture clearances with other Divisions
- J. Perform work in accordance with applicable codes and standards enforced by local authorities.
- K. Where automatic electronic flushing devices are specified, coordinate installation with Division 26.
- L. All wall penetrations through finished walls are to be caulked water tight at all wet locations
- M. Coordinate dimensions required for minimum fixture clearances with other Divisions.
- N. Provide outlet devices which limit the flow of hot water to lavatories and sinks to a minimum of 0.5 GPM, sized as recommended by the manufacturer and as required under ASHRAE Standard 90-75, paragraph 7.7.2 or local or state energy codes.
- O. Provide deep seal traps under floor drains in toilet rooms, mechanical rooms, and elsewhere as indicated on drawings.
- P. Connect wall hung urinals to waste piping with red brass nipples.
- Q. Provide cast iron p-traps under floor drains.

- R. Install barrier free fixtures in accordance with rules and regulations of the Americans with Disabilities Act (ADA).
- S. Provide 12" minimum access to fixtures with slip-joint connections.

3.02 TESTING

- A. Inspect and test all work to insure that it is installed in accordance with drawings and specification and is functioning as designed. Test procedures and pressure as required by other sections.
- B. Correct all deficiencies found and retest.

3.03 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.
- C. Do not permit use of fixtures.

END OF SECTION

SECTION 230510 - HVAC BASIC REQUIREMENTS AND METHODS

PART 1.00 - GENERAL

1.01 SECTION INCLUDES

- A. This Section prescribes basic execution methods to be utilized for work of all Sections of Division 23.
- B. Products are generic names followed by specific requirements. References to generic names in other Sections of Division 23 shall be construed to mean the products specified in this Section.
- C. Provisions specified in this section apply to all work of Division 23.

1.02 RELATED REQUIREMENTS

- A. Section 01 77 70 - Closeout Procedure.
- B. Section 01 78 00 - Project Records Documents.
- C. Section 09 90 00 - Paints and Coating.
- D. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- F. Section 23 07 10 - HVAC Insulation.
- G. Section 23 33 00 - Air Duct Accessories.

1.03 REFERENCE CODES

- A. FL-A. Use current editions unless noted otherwise.
 - 1. All local codes; city and/or county as applicable.
 - 2. OSHA requirements.
 - 3. International Building Code, current edition.
 - 4. International Fire Prevention Code, current edition.
 - 5. International Mechanical Code, current edition.
 - 6. International Plumbing Code, current edition.
 - 7. Regulations of all other authorities having jurisdiction.
 - 8. International Energy Efficiency Code, current edition.
 - 9. International Gas Code, current edition.

1.04 REFERENCE STANDARDS

- A. Where equipment, materials, or installations are specified, conform with requirements of current standards of recognized technical or industrial organizations, the label or listing of the specified organization will be acceptable evidence.
- B. The following is the list of acceptable recognized technical or industrial organizations:
 - 1. Air Movement and Control Association (AMCA).
 - 2. American Bearing Manufacturers Association Inc (ABMA)
 - 3. American Gas Associations (AGA).
 - 4. American National Standards Institute (ANSI).
 - 5. American Refrigeration Institute (ARI).
 - 6. American Society for Mechanical Engineers (ASME).
 - 7. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - 8. American Society of Plumbing Engineers (ASPE).
 - 9. American Society of Sanitary Engineering (ASSE)
 - 10. American Society for Testing Materials (ASTM).
 - 11. American Water Works Association (AWWA).
 - 12. Associated Air Balance Council (AABC).
 - 13. Cooling Technology Institute (CTI)

14. Hydraulic Institute Standard (HIS)
15. Institute of Electrical and Electronic Engineers (IEEE)
16. National Air Duct Cleaners Association (NADCA)
17. National Environmental Balancing Bureau (NEBB)
18. National Electrical Code (NEC)
19. National Electrical Manufacturers Association (NEMA).
20. National Fire Protection Association (NFPA).
21. South Coast Air Quality Management District (SCAQMD)
22. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) 2005.
23. The Hydronics Institute (HI)
24. Underwriters Laboratories (UL).

1.05 SUBMITTAL DATA AND SHOP DRAWINGS

- A. Procedures: In accord with Section 0130 00 and shall reflect adjustments determined during development of coordinated Drawings.
- B. Submittal materials shall be reviewed for substantial conformity with the intent of the Contract plans and Specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of Contractor which are indicated thereon.
- C. Submit brochures and shop drawings with such promptness as will allow ample time for review and corrections procedures.
 1. Review of submittals will not relieve Contractor of the sole responsibility for correctness of the work.
- D. Product data: Give name or other identification of each item to be provided as part of work of this Contract. Assembled brochures shall show cuts and fully detailed descriptions of manufactured items furnished.
 1. Presentation of brochures shall be in red-colored three-ring binders. Arrange materials in same sequence as Specifications and mark each item in lower right-hand corner with Section, Article, and Paragraph number. Provide separate binder for each section of specification
- E. Shop drawings: Submit shop drawings with detailed descriptions for ductwork and other items which have to be especially fabricated for the project.
- F. Submit equipment layout for any equipment manufactured by other than specified in equipment schedule drawings with the associated ductwork and piping shown to verify adequacy of space for circulation and maintenance.
- G. Scheduled equipment with the indicated capacities, weights, physical dimensions, and electrical characteristics are the basis of design. Equivalent equipment, if specified, may be used; however, any differences between the base of design equipment and equivalent equipment such as weights, physical dimensions, etc., shall be coordinated by Contractor, and any differences which affect the building structural framing or electrical requirements shall be incorporated into the project at no additional cost to Owner.
- H. Submit the following shop drawings and submittals for review:
 1. HVAC:
 - a. Chillers
 - b. Boilers
 - c. Pumps
 - d. Pump suction diffusers
 - e. Air cooled condensers
 - f. Cooling towers
 - g. Coils
 - h. Air handling units

- i. Prefabricated roof curbs, leveled top, and pitched bottom to match roof slope
- j. Fan and coil units
- k. Make up air units
- l. Fans
- m. Evaporative cooling units
- n. Air conditioning units
- o. Split air conditioning systems
- p. Heat pump units
- q. Unit heaters
- r. Radiant heaters
- s. Electric heaters
- t. Air curtains
- u. Unit ventilators
- v. Gravity ventilators
- w. Expansion tanks
- x. Heat exchangers
- y. Air separators
- aa. Sheet metal ductwork material and installation details
- ab. Thermostats and humidistats
- ac. Temperature and humidity sensors
- ad. Vibration isolators and seismic restraints
- ae. Sound traps
- af. Diffusers, registers, and grilles
- ag. Dampers (volume)
- ah. Boiler stack, flue, and vents
- ai. Insulations
- aj. Flow measuring devices
- ak. Pressure gauges
- al. Flow indicators
- am. Constant volume boxes
- an. Filters and filter racks
- ao. Humidifiers
- ap. Piping materials and installation
- aq. Below ground piping manufacturer field installation specialists credentials
- ar. Water treatment systems
- as. Piping valves
- at. Grease hood duct washdown systems (CA only)
- au. Piping accessories (strainers, flanges, unions, etc.)
- av. Water and air balance reports (submit 2 weeks prior to substantial completion request)
- aw. Water and air balance agency certifications
- ax. Control valves and specialties
- ay. Control diagrams
- az. Motors for mechanical equipment

I. Refer to individual section for additional requirements on submittals.

1.06 WARRANTY:

- A. See Section 01 77 00 - Closeout Submittal
- B. See Section 01 78 00 - Project Records Documents
- C. The period of all warranties shall commence upon Substantial Completion for the entirety of the Work, regardless of interim use by Contractor or Owner prior to that date and extend it for one year.
- D. Provide additional warranty terms for equipment as indicated in individual section.

1.07 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 7 years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of documented experience and approved by manufacturer.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- D. Refer to individual section for additional requirements on quality assurance.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect material and equipment from damage. Cover fixtures and plated trim to prevent damage from all causes.
- B. Plug and cap piping and ductwork during installation and maintain free from debris and contamination.
- C. Comply with pertinent provisions of Section 01 66 00.
- D. Protect equipment during transit, storage, and handling to prevent damage and deterioration.
- E. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- F. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.
- G. Refer to individual section for additional requirements on delivery, storage, and handling.

1.09 SUBSTITUTIONS

- A. In accord with Section 01 62 00.
- B. Refer to individual section for additional requirements on substitutions.

1.10 EXAMINATION OF DRAWINGS AND PREMISES

- A. Contractor shall visit the Work site, carefully study the Structural, Architectural, Mechanical, Electrical, and other Drawings, and become thoroughly familiar with requirements of the Work and Contract provisions before submitting its proposal. Extra compensation will not be allowed for extra work claims because Contractor failed to follow these directions.

1.11 CODES, PERMITS, FEES, TESTS, AND INSPECTIONS

- A. All work shall comply with requirements of applicable codes, laws, ordinances, and regulations of all authorities having jurisdiction.
- B. Apply for, obtain, and pay costs for all permits for the installation or construction of the work under this Division, and furnish all Drawings required for same.
- C. Arrange and pay for fees, tests, inspections, etc., and furnish signed, certified, and acceptable copies of transactions to Owner.

1.12 RECORD DRAWINGS

- A. Conform to requirements of Section 01 78 00 and the following:
 - 1. Indicate changes of equipment locations and ratings, alterations in ductwork and piping runs and sizes, changes in installation details, control diagrams, and schedules.
 - 2. Use different colors to indicate deletions and additions. Define use of colors.

1.13 OPERATING INSTRUCTIONS

- A. Upon completion of the work, Contractor shall place a competent person in charge, who will operate the system and instruct Owner's personnel in all details of operation and maintenance.
- B. Provide the following for Division 23:
 - 1. Narrative description of each system, describing form, function, components, capacity, controls, and piping color coding.
 - 2. Valve directory with a tag schedule showing location of each valve, type, number, manufacturer, function, and all operating positions.
 - 3. Piping identification charts.
 - 4. Schedule of major components of each system with manufacturer's catalog data, nameplate data, and parts list.
 - 5. Preventative maintenance schedule for each major component of each system.
 - 6. Pressure test reports.
 - 7. Directory: Names, addresses, and telephone numbers of General Contractor, its subcontractors, and related equipment suppliers, including name of person to contact in each case.
 - 8. Provide a separate listing of all components from each manufacturer and from each supplier.
 - 9. Test and balance reports.
 - 10. Specific manufacturer's warranties. List each piece of equipment covered, with day and date warranty begins, date of expiration, and name, address, and telephone number; and name of person to contact regarding problems during warranty period.
 - 11. Listing of extra stock parts such as gaskets, belts, sheaves, and other parts furnished as part of Contract.
 - 12. Sequence of operation as applicable for each system, with flow diagrams, control diagrams, and a chart of all operational positions.
 - a. Start-up position of each system, with indications for position of all controls.
 - b. Shut-down position of each system, with indications for position of all controls.
 - 13. Sequence for troubleshooting operational problems.
 - 14. Copies of installation instructions provided with all control devices.

1.14 COORDINATED DRAWINGS

- A. The trades responsible for the work of this Division shall assist General Contractor in preparing coordinated Drawings in accord with Section 01 30 00.
- B. Coordinated Drawings at ¼ inch per foot minimum scale shall include but not be limited to:
 - 1. Concrete pads and foundations including anchor bolt and sleeve locations.
 - 2. Plans and sections including:
 - a. Support column locations.
 - b. Locations and dimensions for required foundations and pads.
 - c. Locations and dimensions of equipment, plenums, ductwork, piping, controls, control panels, VFD's starters, service clearances, and coil pull areas
 - d. Dimensioned floor drain and floor sink locations.
 - e. Locations of wall mounted equipment.
 - f. Trench locations and sizes.
 - g. Sleeve locations in mechanical and equipment rooms.
 - h. Electrical raceways and panels.
 - 3. Roof layouts including:
 - a. Air intakes.
 - b. Plumbing and mechanical vents.
 - c. HVAC Equipments.
 - 4. Fire protection systems.

1.15 SERVICE INTERRUPTIONS

- A. Wherever possible, arrange work so that there will be no service interruption of any existing system.
- B. When service interruptions are mandatory, arrange in advance with Owner as to the time and date such interruptions will be permitted.
- C. Put interrupted services back into operation as soon as is practical and in accord with the Owners requirements.
- D. Provide training on operation of chillers, boilers, air handling units, compressor and pumps for owner representative.

1.16 ROUTING OF DUCTWORK AND PIPING

- A. Drawings indicate in diagrammatic form the desired engineering intent. Contractor shall include adequate allowances in its bid to properly perform the work, and shall provide the following:
 - 1. Rerouting, rearrangement, and offsetting of ducts and piping to fit the work into available spaces.
 - 2. All openings in non-structural elements, as required for final detailed layout.
 - 3. Coordination and sufficient detailing of all mechanical work to accomplish final installation of all systems in accord with Contract requirements.
 - 4. Coordination with other trades.
 - 5. Required changes in duct sizes. Maintain same pressure drop in ducts carrying less than 6000 cfm. Maintain same velocity in ducts carrying 6000 cfm and over. Do not exceed aspect ratio of 3:1 without written permission from Walt Disney Company mechanical engineer.

PART 2.00 - PRODUCTS

2.01 MATERIALS - GENERAL

- A. All materials shall be new and the best of their respective kinds.
- B. Exposed finish trim, fittings, and pipe in finished rooms or spaces shall be chromium plated brass or be covered with chromium plated brass sleeves. Inside of cabinets exposed to view when doors are open shall be construed to be finished space.
- C. Provide valves with trim as recommended by manufacturer for service on which installed. Use extended 6 inch trim for insulated piping.
- D. Provide same type materials by one manufacturer throughout project.
- E. Standard lists of materials herein may include products not required for this project.

PART 3.00 EXECUTION

3.01 INSTALLATION OF EQUIPMENT:

- A. General
 - 1. It is intended that workmanship be the best standard practice of each trade.
 - 2. Protect equipment from damage from every cause. Exercise particular care to cover/protect equipment during concrete, plaster, and painting operations.
 - 3. Install all floor-mounted or roof-mounted equipment on 6 in. high concrete (housekeeping) pads as indicated on Drawings. Pads shall be sized for footprint of equipment plus minimum of 6 in. in every direction. Check the pad's size for substitute equipment.
 - a. Provide all foundation bolts required and coordinate size, shape, and location of pads with concrete trades in Division 3.
 - 4. Install equipment in location and orientation to provide best access and best piping arrangement.
- C. Access to equipment:

1. Service access: Install equipment in readily accessible locations or provide all means necessary to readily access equipment.
 - a. Equipment will be deemed to be accessible only if all normal maintenance can be performed with ease by an average size person of 160 lb.
2. Service access doors: Furnish metal access doors to wall and ceiling trades for installation where needed to service concealed valves, controls, and other items of mechanical systems.
 - a. Access doors shall be Milcor or equivalent - Style "AT" for acoustical tile, Style "AP" for acoustical plaster, Style "DW" for drywall, Style "MS" for tile wall, and Style "M" elsewhere.
 - b. Unless indicated otherwise on Drawings, provide 24 in. x 24 in. size with concealed hinges, screwdriver actuated cam latch, and factory prime coating, ready for finish painting on the job by the painting trade.
 - c. Provide access doors with UL 1-1/2 hr. label in 1 hour and 2 hr. construction.
 - d. Access doors are not required in removable (accessible) type ceilings.
- D. Electrically-operated equipment:
 1. Provide motors and equipment to operate on the electrical characteristics as finally installed in the Work. Review electrical Drawings and Specifications, and verify with electrical engineer and electrical trade as necessary to confirm electrical characteristics before ordering motors and equipment.
 2. All motors shall be high efficiency design equivalent to General Electrical Energy Saver Line, and be UL-approved.
 3. Provide single phase motors with integral overload protection.
 4. Where motors will be exposed to weather, they shall be furnished as weather proof type, UL listed for outdoor service.
- E. Safety guards: Provide metal safety guards to enclose drives for shaft ends and exposed moving parts on running equipment.
- F. Grouting: Grout behind all wall hung plumbing fixtures with hard, white, durable plaster type materials to eliminate all voids and cracks, and to provide sufficient plane bearing surfaces for proper mounting.
- G. Lubrication: Lubricate all bearings in accord with manufacturer's recommendations.

3.02 EQUIPMENT CONNECTIONS

- A. Connect metal ductwork to the internally and externally isolated equipment with an approved flexible connection for each ductwork connection. (Refer to Section 23 05 48)
- B. Connect piping to the internally and externally isolated equipment with an approved flexible connector for each piping connection. (Refer to Section 23 05 48)

3.03 INSPECTIONS AND TESTS

- A. Welding inspection:
 1. X-ray of welds: Owner intends to make random radiographic examinations of at least 25% of welded joints. If 10% or more of the welds examined are shown to be defective, Owner will make radiographic examinations of 100% of all welds at Contractor's expense. Such inspection shall be performed after normal working hours.
 2. Owner will perform radiographic inspection and will choose the welds to be radiographed and frequency of such inspection each day as the Work progresses.
 3. All defective welds shall be repaired in accord with the governing authority. All repaired and/or replaced welds shall be checked by radiographic examination to ensure corrections have been made. All corrections and/or re-examinations shall be paid for by Contractor.
- B. Holiday testing:

1. All wrapped conduit, pipe, fittings and field joints shall be tested on the job site, after assembly, with an approved high voltage holiday detector, signaling device to indicate any flaws, holes, or breaks in the wrapping.
 2. All testing will be conducted by Contractor and may be verified by Owner.
 3. Where any holidays and any portion of the wrap is damaged or defective, the pipe or conduit shall be prime coated and repaired with no less than two complete wraps of the tape.
 4. No wrapped pipe or conduit shall be covered until the testing and necessary repairs have been completed and accepted.
 5. Prior to starting the test, all piping shall be completed and placed in the bottom center of the trench on temporary smooth padded blocks which will allow the testing electrode to be run along the underside of the pipe.
 6. After all testing and all necessary repairs have been completed, the temporary blocks shall be carefully removed.
- C. Pressure testing:
1. Test all systems in accord with governing codes. Where tests are not specified or required by code, test the system to 1-1/2 times the maximum operating pressure with water for 6 hours with no loss in pressure except changes caused by temperature change. For compressed air and gas systems, air may be substituted as the testing medium.
 2. Notify Owner 48 hr. in advance of all tests.

3.04 ADJUSTING AND CLEANING

- A. General: At completion of work, leave entire installation in a neat, clean, and usable condition acceptable to Owner.
- B. Chromium: Polished.
- C. Flush out all water and steam lines with potable water. For heating and cooling piping systems, introduce a cleaning solution such as trisodium phosphate during flushing to degrease the system. Dispose of effluent in a manner acceptable to codes. Continue to flush until neutral pH is attained.
- D. After cleaning of system and equipment, carefully adjust all parts of all systems for normal operation.
- E. Storage: Protect piping, valves, and accessories from weather and store them indoors. Maintain piping and valve temperatures higher than the ambient dew-point temperature. If outdoor storage is necessary, support piping and valves off the ground or pavement in dry watertight enclosures.

3.05 PAINTING

- A. Provide all apparatus and equipment with a shop coat at factory. Prepare all insulation for painting.
- B. Thoroughly clean and paint exposed pipe threads on insulated piping with two coats of rust-inhibitive paint.
- C. Except air handling units which are factory painted, provide finish painting of all equipment, apparatus, supports, exposed piping, ductwork, and insulation. See Section 09 90 00 for additional clarification as applicable.

3.06 TRAINING

- A. Train the Owner's maintenance personnel on start-up and shut-down procedures, trouble-shooting procedures, and servicing and preventative maintenance schedules and procedures.
- B. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel for items listed herein.

- C. Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals specified in Section 01 79 00.
- D. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.
- E. Provide additional training programs as indicated in individual section.

3.07 BUILDING FLUSH-OUT

- A. Perform building flush-out before occupancy.
- B. Do not start flush-out until:
 - 1. All construction is complete.
 - 2. HVAC systems have been tested, adjusted, and balanced for proper operation.
 - 3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
 - 4. New HVAC filtration media have been installed.
- C. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 7,000 cubic feet per square foot of floor area has been supplied.
 - 1. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.
 - 2. Maintain interior temperature of at least 60 degrees F.
 - 3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
- D. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.

1.02 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Champion America, Inc: www.Champion-America.com.
- C. Seton Identification Products: www.seton.com/aec.
- D. Substitutions: Not permitted.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
 - 2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.

3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
 4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
 5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
 6. Ductwork and Equipment: 2-1/2 inch high letters.
- B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

- A. Color: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
 1. HVAC Equipment: Yellow.
 2. Fire Dampers and Smoke Dampers: Red.
 3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 09 90 00.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify thermostats relating to terminal boxes or valves with nameplates.
- J. Identify valves in main and branch piping with tags.
- K. Identify air terminal units and radiator valves with numbered tags.
- L. Tag automatic controls, instruments, and relays. Key to control schematic.

- M. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- N. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- O. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.
- C. Measurement of final operating condition of HVAC systems.
- D. Sound measurement of equipment operating conditions.
- E. Vibration measurement of equipment operating conditions.
- F. Commissioning activities.

1.02 RELATED REQUIREMENTS

- A. Not Applicable.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Not Applicable.

1.04 REFERENCE STANDARDS

- A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.
- B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to the Construction Manager.
 - 2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 3. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Identification and types of measurement instruments to be used and their most recent calibration date.
 - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - e. Final test report forms to be used.
 - f. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.

- g. Expected problems and solutions, etc.
 - h. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
 - j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
 - k. Confirmation of understanding of the outside air ventilation criteria under all conditions.
 - l. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - m. Method of checking building static and exhaust fan and/or relief damper capacity.
 - n. Proposed selection points for sound measurements and sound measurement methods.
 - o. Methods for making coil or other system plant capacity measurements, if specified.
 - p. Time schedule for TAB work to be done in phases (by floor, etc.).
 - q. Description of TAB work for areas to be built out later, if any.
 - r. Time schedule for deferred or seasonal TAB work, if specified.
 - t. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
 - u. Interstitial cavity differential pressure measurements and calculations, if specified.
 - v. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
 - w. Procedures for formal progress reports, including scope and frequency.
 - x. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Field Logs: Submit at least once a week to Construction Manager.
- E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- F. Progress Reports.
- G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- 1. Submit under provisions of Section 01 40 00.
 - 2. Submit to the Construction Manager within two weeks after completion of testing, adjusting, and balancing.
 - 3. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 5. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 - 6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 8. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
 - 9. Test Reports: Indicate data on AABC MN-1 forms. Submit data in SI (metric) units.
 - 10. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.

- f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Report date.
- H. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.06 QUALITY ASSURANCE

- A. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.
- B. Perform Work under supervision of AABC Certified Test and Balance Engineer experienced in performance of this Work and licensed in the State in which the Project is located.

1.07 PRE-BALANCING MEETING

- A. Convene a meeting one week prior to commencing work of this Section.

1.08 SEQUENCING AND SCHEDULING

- A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
- B. Schedule and provide assistance in final adjustment and test of smoke control system with Fire Authority.

1.09 WARRANTY

- A. Furnish AABC National Performance Guaranty for this project.

PART 2 EXECUTION

2.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Air coil fins are cleaned and combed.
 - 8. Access doors are closed and duct end caps are in place.
 - 9. Air outlets are installed and connected.
 - 10. Duct system leakage is minimized.
 - 11. Hydronic systems are flushed, filled, and vented.
 - 12. Pumps are rotating correctly.
 - 13. Proper strainer baskets are clean and in place.
 - 14. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

- C. Beginning of work means acceptance of existing conditions.

2.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

2.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 5 percent of design.

2.05 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

2.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

2.07 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

2.08 COMMISSIONING

- A. See Sections 01 91 13 and 23 08 00 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
 - 1. Air side systems.
 - 2. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. Re-check a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.
 - 1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
 - 2. Use the same test instruments as used in the original TAB work.
 - 3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
 - 4. For purposes of re-check, failure is defined as follows:
 - a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
 - b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
 - c. Temperatures: Deviation of more than one degree F.
 - d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
 - e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
- F. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
 3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

2.09 SCOPE

- A. Test, adjust, and balance the following:
1. Air Cooled Refrigerant Condensers
 2. Packaged Roof Top Heating/Cooling Units
 3. Packaged Terminal Air Conditioning Units
 4. Computer Room Air Conditioning Units
 5. Air Coils
 6. Air Handling Units
 7. Fans
 8. Air Filters
 9. Air Inlets and Outlets

2.10 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
1. Manufacturer
 2. Model/Frame
 3. HP/BHP
 4. Phase, voltage, amperage; nameplate, actual, no load
 5. RPM
 6. Service factor
 7. Starter size, rating, heater elements
 8. Sheave Make/Size/Bore
- B. V-Belt Drives:
1. Identification/location
 2. Required driven RPM
 3. Driven sheave, diameter and RPM
 4. Belt, size and quantity
 5. Motor sheave diameter and RPM
 6. Center to center distance, maximum, minimum, and actual
- D. Combustion Equipment:
1. Boiler manufacturer
 2. Model number
 3. Serial number
 4. Firing rate
 5. Overfire draft

6. Gas meter timing dial size
 7. Gas meter time per revolution
 8. Gas pressure at meter outlet
 9. Gas flow rate
 10. Heat input
 11. Burner manifold gas pressure
 12. Ambient temperature
- E. Air Cooled Condensers:
1. Identification/number
 2. Location
 3. Manufacturer
 4. Model number
 5. Serial number
 6. Entering DB air temperature, design and actual
 7. Leaving DB air temperature, design and actual
 8. Number of compressors
- F. Cooling Coils:
1. Identification/number
 2. Location
 3. Service
 4. Manufacturer
 5. Air flow, design and actual
 6. Entering air DB temperature, design and actual
 7. Entering air WB temperature, design and actual
 8. Leaving air DB temperature, design and actual
 9. Leaving air WB temperature, design and actual
 14. Saturated suction temperature, design and actual
 15. Air pressure drop, design and actual
- G. Heating Coils:
1. Identification/number
 2. Location
 3. Service
 4. Manufacturer
 5. Air flow, design and actual
 10. Entering air temperature, design and actual
 11. Leaving air temperature, design and actual
 12. Air pressure drop, design and actual
- H. Return Air/Outside Air:
1. Identification/location
 2. Design air flow
 3. Actual air flow
 4. Design return air flow
 5. Actual return air flow
 6. Design outside air flow
 7. Actual outside air flow
 8. Return air temperature
 9. Outside air temperature
 10. Required mixed air temperature
 11. Actual mixed air temperature
 12. Design outside/return air ratio
 13. Actual outside/return air ratio
- I. Exhaust Fans:

1. Location
 2. Manufacturer
 3. Model number
 4. Serial number
 5. Air flow, specified and actual
 6. Total static pressure (total external), specified and actual
 7. Inlet pressure
 8. Discharge pressure
 9. Sheave Make/Size/Bore
 10. Number of Belts/Make/Size
 11. Fan RPM
- J. Duct Traverses:
1. System zone/branch
 2. Duct size
 3. Area
 4. Design velocity
 5. Design air flow
 6. Test velocity
 7. Test air flow
 8. Duct static pressure
 9. Air temperature
 10. Air correction factor
- K. Duct Leak Tests:
1. Description of ductwork under test
 2. Duct design operating pressure
 3. Duct design test static pressure
 4. Duct capacity, air flow
 5. Maximum allowable leakage duct capacity times leak factor
 6. Test apparatus
 - a. Blower
 - b. Orifice, tube size
 - c. Orifice size
 - d. Calibrated
 7. Test static pressure
 8. Test orifice differential pressure
 9. Leakage
- M. Flow Measuring Stations:
1. Identification/number
 2. Location
 3. Size
 4. Manufacturer
 5. Model number
 6. Serial number
 7. Design Flow rate
 8. Design pressure drop
 9. Actual/final pressure drop
 10. Actual/final flow rate
 11. Station calibrated setting

END OF SECTION

SECTION 230710 - HVAC INSULATION

PART 1.00 - GENERAL

1.01 GENERAL PROVISIONS

- A. Provisions specified in Section 23 05 10, HVAC Basic Mechanical Requirements and Methods, apply to all work of Divisions 23.

1.02 SECTION INCLUDES

- A. Thermal insulation of all pipe, fittings, valves, equipment, and ductwork.

1.03 RELATED REQUIREMENTS

- A. Section 09 90 00 - Paints and Coatings.
- B. Section 23 05 10 - Basic Mechanical Requirements and Methods.
- C. Section 23 21 13 - HVAC Piping.
- D. Section 23 31 00 - HVAC Ducts and Casing.

PART 2.00 - PRODUCTS

2.01 FIBERGLASS MANUFACTURERS

- A. Owens-Corning
- B. Pittsburgh Corning
- C. Knauf FiberGlass
- D. Manson Insulation Corporation
- E. Johns Manville

2.02 CALCIUM SILICATE MANUFACTURERS

- A. Johns Manville
- B. Owens-Corning

2.04 GENERAL

- A. Provide all materials UL-listed as flame-retardant or non-combustible.
- B. Insulation flame spread rating and smoke development not to exceed 25 and 50.
- C. Provide all exposed pipe insulation with cloth jackets sized in place ready for painting.
- D. Provide concealed pipe insulation with pre sized jackets.

2.05 COLD PIPES

- A. 1-1/2 in. thick, preformed, 5.6 lb. density fiberglass with vapor barrier, with K = 0.23 at 75°F.

2.06 HOT PIPES

- A. 1 in. thick up to and including 2 in. pipe size, 1-1/2 in. thick for 2-1/2 in. pipe size and larger, preformed, 5.6 lb. density fiberglass with K = 0.23 at 75°F.

2.07 CONDENSATE DRAIN (PRIMARY AND SECONDARY) PIPES

- A. 1/2 in. thick glass fiber pipe insulation, 3 pcf minimum density, with fire-retardant vapor barrier and white Kraft jacket.

2.08 PIPE FITTINGS

- A. Hand molded insulating cement with premolded rigid jacket cemented in place.

2.09 CONCEALED DUCTS

- A. 1-1/2 in. thick, 1-1/2 lb. density fiberglass blanket, with vapor barrier (except lined ductwork).

2.10 EXPOSED DUCTS

- A. Indoor application (except lined ductwork): 1 1/2 in. thick, 1-1/2 lb. density fiberglass blanket, with vapor barrier and 8 oz. canvas jacket.
- B. Outdoor application (except lined ductwork): 2 in. thick, 1-1/2 lb. density fiberglass blanket, with vapor barrier and weatherproof jacket.
- C. In equipment rooms provide 5.6 lb. density fiberglass board instead of 1-1/2 lb. density blanket.

2.11 LINED DUCTS

- A. Line ductwork as indicated on Drawings.
- B. Refer to Section 23 31 00.

2.12 WEATHERPROOF JACKETING

- A. All insulation exposed to the weather and other insulation specified to be weatherproof shall be jacketed with a minimum 0.032 in. thick aluminum weatherproof jacket with standing seam and aluminum fitting covers.

2.13 TANKS AND HEAT EXCHANGERS

- A. 2 in. thick calcium silicate, 1 in. mesh chicken wire, 1/4 in. thick insulating cement, 8 oz. canvas jacket, and sized ready for painting.

2.15 PACKAGED EQUIPMENT

- A. Insulate chillers, and similar type equipment as specified for tanks and heat exchangers, unless factory insulated with equivalent insulation.

2.16 ADHESIVE AND SIZE

- A. Arabol or Benjamin Foster, rodent resistant fire retardant.

2.17 REFRIGERANT PIPING

- A. Insulate refrigerant suction piping with 1 in. thickness (R = 4.0) for up to 1 in. pipe and 1-1/2 in. thickness (R = 6.0) for 1-1/4 in. and larger pipe. Insulation shall be Rubatex "Insul-Lock" or Armstrong "AP Armaflex SS" flexible foamed polyethylene. Insulate valves and fittings with same thickness as piping with butt strips and finish.

PART 3.00 - EXECUTION

3.01 PIPE INSULATION

- A. General: Apply all pipe insulation with rodent-resistant lagging adhesive, Arabol or equal, neatly pasted in place to form a neat workmanlike appearance.
 - 1. All exposed insulation shall have canvas jacket applied and sized in place.
 - 2. Concealed insulation may be pre sized.
- B. Cold pipes: Insulate the following lines as specified for cold pipes:
 - 1. Chilled water piping systems.
 - 2. Dual temperature hot-chilled water piping systems.
 - 3. Domestic chilled water piping systems.
- C. Hot pipes: Insulate the following lines as specified for hot pipe systems.
 - 1. Hot water (space heating) piping systems.
 - 2. Steam piping systems.
 - 3. Steam condensate return piping systems.
- D. Condensate drain (primary and secondary) pipes: Insulate the following lines:
 - 1. Condensate pipes from HVAC units to point of discharge.

3.02 DUCT INSULATION

- A. Provide insulation for the following:
 - 1. All supply air ductwork, except where lined ductwork is indicated on Drawings. Refer to Section 23 31 00 for duct lining specifications.

2. All unlined return air ductwork in non-conditioned spaces.
 3. All outside air intake ductwork to air delivery equipment where outside air duct passes through a conditioned space or a return/relief air plenum.
 4. Other ducts where specifically noted on Drawings.
- B. Indoor ducts:
1. Concealed ducts: Install blanket insulation tight and smooth. Secure to ducts having long sides or diameters as follows:
 - a. Smaller than 24 in.: Class 2 bonding adhesive applied in 6-in.-wide transverse strips on 12-in. centers.
 - b. 24 in. and larger: Anchor pins spaced 12 in. apart each way. Apply bonding adhesive to prevent sagging of the insulation.
 - c. Overlap joints 3 in.
 - d. Seal joints, breaks, and punctures with vapor barrier compound.
 - e. Insulation on exposed ducts shall be secured in place with adhesive and insulation pins, and cover the entire assembly with 8 oz. canvas pasted in place.
 - 1) Fit all corners of ducts in equipment rooms with metal angles before canvas is applied.
- C. Insulation omitted: Do not insulate any of the lined ductwork exposed to outdoors and any of indoor exhaust air ductwork unless indicated otherwise on Drawings or specified.

3.03 PLENUM INSULATION

- A. Internally insulate in field all accessible plenums as specified for duct lining in Section 23 3100.

3.04 TANK AND HEAT EXCHANGER INSULATION

- A. Insulate all tanks over 100°F operating temperature, and all heat exchangers. Wire calcium silicate blocks in place securely with 14 gauge annealed steel wire. Cover with 1 in. mesh chicken wire and 1/4 in. minimum thickness of plaster. Paste canvas jacket neatly in place and size ready for painting.
1. Boilers and chillers are considered as heat exchangers and shall be field insulated unless equivalent factory insulation has been provided.

3.05 BOILER AND WATER HEATER STACK AND FLUES

- A. Insulate all boiler and water heater stacks, flues, breechings, and flue connectors as specified for tanks and heat exchangers.
1. Insulation may be omitted on double wall water heater flues and on water heater flue connectors.

3.07 WEATHERPROOFING

- A. Weatherproof all insulation exposed to outdoor or excessive moisture, and elsewhere as indicated. Install aluminum jacket in accord with manufacturer's instructions.

3.08 PROTECTIVE COVERING

- A. Install aluminum jacket (same as specified for weather protection) on all exposed insulation within 6 ft. of floor or grade, to protect insulation from physical damage.

END OF SECTION

SECTION 230713 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct Liner.
- C. Insulation jackets.

1.02 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting and Coating: Painting insulation jackets.
- B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- C. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

- A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.
- B. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate Metric; 2007.
- C. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.
- D. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2008.
- E. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2009.
- F. ASTM C 916 - Standard Specification for Adhesives for Duct Thermal Insulation; 1985 (Reapproved 2007).
- G. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.
- H. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.
- I. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.
- J. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 1996 (Reapproved 2002).
- K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- L. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than ten years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Knauf Insulation;
 - 2. Johns Manville Corporation;
 - 3. Owens Corning Corp;
 - 4. CertainTeed Corporation;
 - 5. Substitutions: Not permitted.
- B. Insulation: ASTM C 553; flexible, noncombustible blanket.
 - 1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C 518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Sorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Outdoor Vapor Barrier Mastic:
- F. Tie Wire: Annealed steel, 16 gage.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. Knauf Insulation;
 - 2. Johns Manville Corporation;
 - 3. Owens Corning Corp;
 - 5. Substitutions: Not permitted.
- B. Insulation: ASTM C 612; rigid, noncombustible blanket.

1. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C 518.
 2. Maximum service temperature: 450 degrees F.
 3. Maximum Water Vapor Sorption: 5.0 percent.
 4. Maximum Density: 8.0 lb/cu ft.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
 2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

- A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
1. Lagging Adhesive:
 - a. Compatible with insulation.
- B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.
- C. Aluminum Jacket: ASTM B 209 (ASTM B 209M).
1. Thickness: 0.016 inch sheet.
 2. Finish: Smooth.
 3. Joining: Longitudinal slip joints and 2 inch laps.
 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
 6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated ducts conveying air below ambient temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated ducts conveying air above ambient temperature:
 1. Provide with or without standard vapor barrier jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- F. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Secure insulation without vapor barrier with staples, tape, or wires.
 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

- A. Combustion Air Duct:
1. Double Wall B-Vent
- B. Exhaust Ducts Within 10 ft of Exterior Openings:
1. Flexible Glass Fiber Duct Insulation: 1.5" inches thick.
 2. Rigid Glass Fiber Duct Insulation: 2" inches thick.
 3. Flexible Glass Fiber Duct Liner Insulation: 1.5" inches thick.
 4. Rigid Glass Fiber Duct Liner Insulation: 2 inches thick.
- C.. Outside Air Intake Ducts:
1. Rigid metal duct with 2" flexible glass fiber duct insulation.
- D. Ventilation Equipment Casings:
1. Minimum 2" Thick rigid foam casing insulation.
- E. Supply Ducts:
1. Flexible Glass Fiber Duct Insulation: 1.5" inches thick.
 2. Rigid Glass Fiber Duct Insulation: 2" inches thick.
 3. Flexible Glass Fiber Duct Liner Insulation: 1.5" inches thick.
 4. Rigid Glass Fiber Duct Liner Insulation: 2 inches thick.
- F. Supply ducts After Terminal Boxes:
1. Flexible Glass Fiber Duct Insulation: 1.5" inches thick.
 2. Rigid Glass Fiber Duct Insulation: 2" inches thick.
 3. Flexible Glass Fiber Duct Liner Insulation: 1.5" inches thick.
 4. Rigid Glass Fiber Duct Liner Insulation: 2" inches thick.
- M. Return and Relief Ducts in Mechanical Room:
1. Flexible Glass Fiber Duct Insulation: 2" inches thick.
 2. Rigid Glass Fiber Duct Insulation: 2" inches thick.
 3. Flexible Glass Fiber Duct Liner Insulation: 2" inches thick.
 4. Rigid Glass Fiber Duct Liner Insulation: 2" inches thick.

END OF SECTION

SECTION 230805 – PERFORMANCE TEST AND ADJUSTMENT OF HVAC SYSTEMS

PART 1 GENERAL

1.01 GENERAL PROVISIONS

- A. Provisions specified in Section 23 05 10, HVAC Basic Mechanical Requirements and Methods, apply to all work of Divisions 23.

1.02 SUMMARY

- A. This section covers the Contractor's responsibilities for deferred (Seasonal) Functional (Performance) Tests. The testing and adjustment will be performed after construction is completed and the building is fully occupied.
- B. Performance Testing and Adjustment of Mechanical Systems; Each subcontractor or installer responsible for the installation of a particular system or equipment item to be tested and adjusted is responsible for the commissioning activities relating to that system or equipment item.
- C. The entire mechanical systems shall be seasonal performance tested and adjusted including activities for the following specific items:
 - 1. HVAC Systems:
 - a. Air handlers
 - b. Fan & coil units
 - c. Fans

1.03 RELATED REQUIREMENTS

- A. Section 23 05 10 - Basic Mechanical Requirements and Methods.
- B. Section 23 05 93 - Testing, Adjusting, and Balancing (TAB).

1.04 REFERENCE STANDARDS

- A. ASHRAE Guideline 1.1 - 2007, HVAC & R Technical Requirements for the Commissioning Process

1.05 SUBMITTALS

- A. Submittal procedures:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Project Mechanical Engineer; in that case, submit to Project Mechanical Engineer first.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.
 - 3. Make submittals on time schedule specified by Commissioning Authority.
 - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority for preparation of testing and adjustment summary to the Owner; submit in editable electronic format, Microsoft Word preferred.
 - 5. As soon as possible after submittals made to Project Mechanical Engineer are approved, submit copy of approved submittal to the Commissioning Authority.
 - a. Submit all system trend logs; Logs to indicate dates, times and ambient temperatures when the trends were made.
 - b. Summary report of all set points and adjustments made during performance testing and adjustment activities.
 - c. Prepare a bound manual of test results for each of the weather extremes and any recommendations of follow up testing to maintain maximum central plant performance.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate with TAB schedule of completion and acceptance.
- C. Make final approved TAB report available to the Commissioning Authority.

3.02 EMS COORDINATION

- A. Coordinate with the completion of the EMS (BAS) Commissioning.
- B. Review the final commissioning reports for Prefunctional Checklist for the Controls (BAS) and the Calibration Procedures (sensors; actuators) to determine if the calibration is within the tolerance required for performance testing required by this section.
- C. Make final approved TAB report available to the Commissioning Authority.

3.03 PERFORMANCE TESTING AND TRENDING PROCEDURES

- A. Pre-functional Check lists and Functional Tests for the control system, air handler unit and other mechanical system components shall be completed and submitted to the Commissioning Authority. Check lists shall be signed and dated, certifying that all system programming is completed as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.
- B. Do not start trending and testing until all controlled components have themselves been successfully commissioned in accordance with the Contract Documents.
- C. Before starting the testing and trending phase, monitor all set points for the mechanical systems that will be performance tested and trended. Make set point adjustment based on fully occupied building spaces.
 - 1. Set point changing features and functions.
 - 2. Sensor calibrations.
 - 3. Confirm that features that are included but not specified to be setup are actually installed.
- D. During the trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the EMS control system:
 - 1. Demand limiting, including over-ride of limiting.
 - 2. Sequential staging ON of equipment; optionally demonstrate manually.
 - 3. Optimum start-stop functions.
- E. During Performance Testing and trending phase, use only skilled technicians, who are familiar with the systems to be tested.

3.04 MECHANICAL SYSTEM PERFORMANCE TESTING AND TRENDING

- A. Scope:
 - 1. To verify that the HVAC and other mechanical systems are functioning as designed, meeting all of the conditions and set points while controls are set in automatic mode.
 - 2. Testing to verify that the system is meeting all of the design conditions during peak demand and minimum demand.
- B. Methods:
 - 1. Utilize the existing Carrier Comfort Works (CCW) to the extent to provide an operational trends log for the testing and verification. Before the trend logging is started, the accuracy of all sensors including flow meters that would be needed in

- the operational testing shall be completed. If these devices need calibration and or replacement, MECHANICAL Scientific System will perform this task.
2. Performance Testing to be performed under summer (August or September) conditions. Summer testing to be performed when the daily average high temperature is estimated to be 95 degrees or greater.
 3. Additional output programming will be necessary by Carrier to include coordinating all data for trend logging. Coordinated with DCA's Scientific System for trend reporting.
 4. Testing shall be for a continuous period of a minimum of 5 days including Saturday and Sunday. During the test period, all air handlers and fan and coil unit shall be included in the test. The trend logs shall show operating conditions of all systems for the same period. Outside air conditions (dry bulb, wet bulb and relative humidity) shall be trended for the period.
 5. Trend report each of HVAC and other mechanical systems to include the following:
 - a. Air Handlers: Mixed air (EAT); cold deck temperature (LAT); CFM (duct transverse velocity readings x duct area); sensible heat (btuh -tons) (Calculated); space temperature and humidity.
 - b. Fan and Coil Units: Mixed air (EAT); cold deck temperature (LAT); CFM (duct transverse velocity readings x duct area); sensible heat (btuh -tons) (Calculated); space temperature.
 6. Air Handler and Fan and Coil Trends: The trend logs shall include the calculated cooling load being supplied against the capacities listed on the Equipment Schedule. The calculated cooling load shall be within 10 percent of the capacity listed on the Equipment Schedule. If the capacity is outside of 10 percent, then the test period will increase to continuous 5 days or until the capacity is within the 10 percent. After the third extension is completed and the 10 percent of capacity is not attained, the test shall be stopped. Analyze how to enable and maintain the heat balance within 10 percent. Submit analysis to Project Mechanical Engineer to determine what further action is to be taken.

3.05 HVAC SYSTEM ADJUSTMENT

- A. Scope:
 1. Adjust the Air Handler fan's variable frequency drives (VFD) to accomplish the least cooling air flow to maintain building spaces at the required space temperature. Reducing the air flow will accomplish the least fan energy.
- B. Methods:
 1. Reduce the supply and return air fan speed to the point that the building space temperature set point cannot be maintained. The fan speed to be controlled from input signals to the VFD on the supply and return fans from the EMS. Trend log space temperatures along with relative humidity for all the zones on the Air Handler where the fan speed is being adjusted. The period of the trending shall be continuous for a minimum of 5 days including Saturday and Sunday. Throughout the trending period, room temperature variation shall be within 2 degrees of the set point and the relative humidity shall not exceed 55 percent.
 2. At the conclusion of the adjustment, measure the air flow (CFM) for each zone via a transverse duct measurement. Record the final CFM and submit to the Commissioning Authority. Include in the final report the fan motor amperage before and after the final adjustment to the fan speed.

END OF SECTION

SECTION 230913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Air supply system.
- B. Thermostats.
- C. Humidistats.
- D. Automatic dampers.
- E. Damper operators.

1.02 RELATED REQUIREMENTS

- E. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.
- G. Section 26 27 26 - Wiring Devices: Elevation of exposed components.

1.03 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods for Testing Dampers for Rating; Air Movement and Control Association International, Inc.; 2007.
- B. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; National Electrical Manufacturers Association; 2008.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Manufacturer's Instructions: Provide for all manufactured components.
- E. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.
- F. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

- C. Installer Qualifications: Company specializing in performing the work of this section documented experience approved by manufacturer.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Substantial Completion.

1.08 MAINTENANCE SERVICE

- A. Provide service and maintenance of control system for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. United Technologies system.
- B. Substitutions: Not permitted.

2.02 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 AIR SUPPLY

2.04 DAMPERS

- A. Performance: Test in accordance with AMCA 500-D.
- B. Frames: Extruded aluminum, welded or riveted with corner reinforcement, minimum.
- C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum, attached to minimum 1/2 inch shafts with set screws.
- D. Jamb Seals: Spring stainless steel.
- E. Linkage Bearings: Oil impregnated sintered bronze.
- F. Leakage: Less than one percent based on approach velocity of 2000 ft/min and 4 inches wg.
- G. Temperature Limits: -40 to 200 degrees F.

2.05 DAMPER OPERATORS

- A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
 - 1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
 - 2. Provide one operator for maximum 20 sq ft damper section.
- B. Electric Operators:

1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.
 2. Product: Belimo
 - a. Substitutions: Not permitted.
- C. Inlet Vane Operators:
1. High pressure with pilot positioners and sufficient force to move vanes when fan is started with vanes in closed position. Return vane operator to closed position on fan shutdown.

2.07 HUMIDISTATS

- A. Room Humidistats:
1. Wall mounted, proportioning type.
 2. Throttling range: Adjustable 2 percent relative humidity.
 3. Operating range: 30 to 80 percent.
 4. Maximum temperature: 110 degrees F.
 5. Cover: Set point indication.
 6. Product: Vaisala
 - a. Substitutions: Not permitted.
- B. Limit Duct Humidistat:
1. Insertion, two position type.
 2. Throttling range: Adjustable 2 percent relative humidity.
 3. Operating range: 20 to 80 percent.
 4. Maximum temperature: 150 degrees F.
 5. Product: Vaisala
 - a. Substitutions: Not permitted.

2.08 INPUT/OUTPUT SENSORS

- A. Static Pressure Sensors:
1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
 2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
 3. Accuracy: One percent of full scale with repeatability 0.3 percent.
 4. Output: 0 - 5 vdc with power at 12 to 28 vdc.
 5. Product: United Teconologies
- B. Carbon Monoxide Detectors:
1. Single or multichannel dual level detectors, using solid state sensors with three year minimum life. Sensor replacement shall take maximum 15 minutes. Suitable over temperature range of 23 to 130 degrees F.
 2. Provide individual indicators and contractors for each level, initially calibrated for 50 ppm and 100 ppm.
 3. Maximum response time to 100 ppm CO calibration gas: Two minutes.

2.09 THERMOSTATS

- A. Electric Room Thermostats:
1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
 2. Service: cooling only.
 3. Covers: Locking with set point adjustment, with thermometer.
 4. Product: Carrier
- B. Line Voltage Thermostats:

1. Integral manual On/Off/Auto selector switch, single or two pole as required.
2. Dead band: Maximum 2 degrees F.
3. Cover: Locking with set point adjustment, with thermometer.
4. Rating: Motor load.
5. Product: Honeywell
 - a. Substitutions: Not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.
- G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 27 26.
- C. Provide guards on thermostats in public areas and where indicated.
- D. Thermostats to be mounted at a maximum of 48" above the finished floor.

END OF SECTION

SECTION 232113 - HVAC PIPING

PART 1 GENERAL

1.01 GENERAL PROVISIONS

- A. Provisions specified in Section 23 05 10, HVAC Basic Mechanical Requirements and Methods, apply to all work of Division 23.

1.02 SECTION INCLUDES

- A. This Section prescribes basic materials and execution methods to be utilized for work of all Sections of Division 23.
- B. Products in Part 2.00 of this Section list generic names followed by specific requirements. References to generic names in other Sections of Division 23 shall be construed to mean the products specified in this Section.
- C. Complete piping system for:
 - 6. Refrigerant piping .

PART 2 PRODUCTS

2.07 REFRIGERANT PIPING:

- A. Type "K" hard copper with soldered fittings and silver soldered joints.

2.08 CONDENSATE DRAIN (PRIMARY AND SECONDARY)

- A. Type "L" hard copper with DWV copper fittings and soldered joints.
- B. Throttling valves: Globe valves.

2.10 PIPE HANGERS AND SUPPORTS

- A. General: Hangers and maximum hanger spacing shall conform to the following:
 - 1. Maximum Spacing Between hangers:

Pipe Size	Rod Size	Cast Iron Pipe	All Other Horizontal	Metal Pipes Vertical	PVC/CPVC Horizontal
3/4	3/8	-	6 ft.	10 ft.	3. ft.
1	3/8	-	6 ft.	10 ft.	3. ft.
1-1/4	3/8	-	6 ft.	One Story	4. ft.
1-1/2	3/8	-	6 ft.	One Story	4. ft.
2	3/8	5 ft.	10 ft.	One Story	4. ft.

- B. Beam attachments: painted finish; B-Line Figure B3050, or Owner-approved equivalent by Secure Strut & Hanger Co., Tolco or Unistrut.
- C. Clevis hangers:
 - 1. Standard hanger for steel pipe: Painted finish B-Line Figure, or Owner-approved equivalent by Secure Strut & Hanger Co., Tolco or Unistrut.
 - 2. For copper pipe: Electro-galvanized plastic coated; B-Line Figure B3100C, or Owner-approved equivalent by Secure Strut & Hanger Co., Tolco or Unistrut.
 - 3. AWWA type for iron pipe; painted finish; B-Line Figure B3102, or Owner-approved equivalent by Secure Strut & Hanger Co., Tolco or Unistrut.
- D. Protection Shields:
 - 1. Insulated pipe: Thermal hanger shield: 360 degree insert of calcium silicate totally encased in sheet metal shield; pipe shields Model A2000 (chilled water) or A3000 (other lines), or equivalent by Uni-Grip, or Insul-shield.

2. Bare pipe: Felt isolator; B-Line figure B3195, or approved equivalent by Secure Strut & Hanger Co. or Unistrut.
- E. Sleeves and flashings:
1. Exterior wall: Wade 3600 or Owner-approved equivalent by Link Seal.
 2. Interior wall: Pipe shields Model WFB-CS, or Owner-approved equivalent by Pipe Shields Inc.
 3. Waterproofed floor: Wade W-3600.
 4. Floors: Pipe shields Model DFB-CS or QDFB-CS.
 5. Furnish materials and coordinate installation for flashing and counter flashing roof penetrations for vents, pipe, drains, and ducts.
 6. Materials:
 - a. Sheet metal : 24 gauge minimum ASTM 525, Class G90.
 - b. Sheet lead: 4 pounds per square foot.
 - c. Stainless steel: Minimum 24 gauge.
 - d. Sheet copper: 16 oz. per square foot.
 - e. Vent stack fitting: Josam1830 or Jay R. Smith 1750.

2.11 MATERIALS - GENERAL

- A. All materials shall be new and the best of their respective kinds.
- B. Exposed finish trim, fittings, and pipe in finished rooms or spaces shall be chromium plated brass or be covered with chromium plated brass sleeves. Inside of cabinets exposed to view when doors are open shall be construed to be finished space.
- C. Provide valves with trim as recommended by manufacturer for service on which installed.
- D. Provide same type materials by one manufacturer throughout project.
- E. Standard lists of materials herein may include products not required for this project.

2.12 PIPE AND TUBE

- A. Steel pipe:
 1. ASTM A53 Grade B, schedule 40, seamless or electric resistance weld; ASTM A106 Grade B; or ASTM A120.
 2. Black or galvanized as specified.
 3. Beveled ends (B.E.), grooved (G.), or threaded and coupled (T&C), as specified in the applicable Division 23 Sections.
- B. Cast iron soil pipe: In accord with current issue of standards of the Cast Iron Soil Pipe Institute. Bitumastic-coated.
 1. Hub and spigot or No-Hub.
 2. Service weight.
- C. Polypropylene pipe: Flame-retardant polypropylene with thermal fusion system for joints; GSR FUSEAL or equivalent by Spirolite.
- D. Copper tube: ASTM B88, 20-ft. straight lengths, except provide soft temper in 60-ft. coils for underground work.
 1. Type "K" except where Type "L" is specified.
 2. Hard temper except where soft temper is specified.
- G. PVC pipe: Sch 40 and Sch 80 Type I, 160 psi at 73 deg. F, ASTM 1785 with solvent cement fittings. Solvent cement and purple cleaner shall be supplied by same manufacturer.
- H. CPVC pipe: Sch. 40 and Sch. 80, 230 psi at 73 deg. F, ASTM F441, with solvent cement fittings. Solvent cement and purple cleaner shall be supplied by same manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION OF PIPING

- A. Refer to Section 23 05 10.
- B. It is intended that workmanship be the best standard practice of each trade.
- C. Run piping parallel to building construction. Do not run piping above electrical equipment.
- D. Unless detailed otherwise or specifically approved in writing by Owner, conceal all piping in walls, partitions, ceilings or furred spaces.
- E. Properly support all equipment and piping from main structural members. Provide secondary structural framing as required. Do not hang equipment or piping directly from slabs or decks.
- F. Properly pitch all piping for proper drainage.
- G. Isolate all piping from building structure.
- H. Where exterior watering piping is required, pipe shall be insulated and have metal insulation jacket.
- I. Properly wrap all copper and steel pipe and fittings below grade.
- J. Make up connections between piping of dissimilar metals with approved dielectric couplings.
- K. Do not permanently close-up, furr-in, or cover-over completed piping runs until they have been inspected and approved.
- L. Install exposed polished or enamel trim connections at fixtures with special care free from tool marks and exposed threads at fittings.
- M. Use reducing/increasing fittings where a change in pipe size occurs in a run.
- N. Bushings of any type are not permitted, except for insertion of the thermometers or gauges.
- O. Unless specifically specified or detailed otherwise, only cast iron soil pipe will be permitted be run beneath floor slabs on grade.
- P. Clean inside of pipe before installing it. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.
- Q. Install pipe so that it does not interfere with the opening of doors or apparatus, access to equipment, or to electrical equipment.
- R. Do not install pipes in such a way that they will appear torque to pumps. After pumps have been installed, and pumps have been operated, recheck and realign pumps if necessary.
- S. Do not install water pipes through electrical rooms, power electronic rooms, electrical equipment rooms, tele/data rooms, , or audio/visual rooms.
- T. Do not install piping above electrical equipment, such as starters, variable frequency drives, motor control centers, or disconnects.
- U. Provide flanges and unions throughout the pipe systems at all equipment. Make provisions for servicing and removal of equipment without dismantling piping.
- V. Piping passing through or under grade beams or through foundation walls, if approved by the project structural engineer, shall be provided with a schedule 40 steel pipe sleeve two sizes greater than the pipes passing through the sleeves.
- Z. Plastic pipe:
 - 1. All plastic pipe shall be joined with proper fittings. Solvent or fusion weld to pipe in accord with manufacturer's recommendations.

AA. Copper Tube:

1. Make all connections and changes of direction with factory fittings, except that tubing may be bent to a radius not less than three times the pipe diameter provided that bends are made using proper bending tools and no appreciable flattening or distortion of tube results.
2. Cut tube with a tubing cutter. Ream and clean ends to a bright finish. Clean inside of fitting sockets to a bright finish.
3. Make-up solder joints with appropriate paste flux and solder with 95/5 solder, unless specified otherwise.
4. Make-up silver solder (brazed) joints with appropriate flux and silver solder with silver brazing alloy.

AF. Drain Pans: Provide 16 gauge galvanized sheet metal drain pans below pipes conducting liquids of any kind as indicated on drawings.

1. Pane shall be 2 1/2 in. deep and reinforced with angle iron frame. Support and brace pans as required.
2. Run 3/4 in. copper drain to waste receptor.

AG. Underground pipe system coating:

1. Protect all underground copper and steel piping as follows, unless specified otherwise:
 - a. Surface preparation: remove oil, grease, rust, scale, moisture, metal burrs, weld slag, and other foreign materials. All sharp points shall be removed.
 - 1) Use Hexane, Toluol, Toluene, Xylol. Do not use oil-based solvents for cleaning.
 - b. Priming: Use JM No. 22 primer to obtain the maximum coating bond to pipe and also to act as a filter for flawed coating surfaces.

AH. Sleeves and escutcheons:

1. Sleeves:
 - a. Provide sleeves for all pipes passing through floors, walls and ceilings. Extend sleeves 2 in. above floors. Make sleeves flush with walls and ceilings.
 - b. At concrete construction, set sleeves, or Owner-approved equivalent, for penetration of underground walls.
 - c. Provide Link Seal wall sleeves, or Owner-approved equivalent, for penetration of underground walls.
 - 1) Escutcheons: Provide chrome-plated hinged escutcheon with set screws at each exposed pipe passing through a wall, floor, or ceiling in finished portions of the building.
 - 2) Escutcheons Shall be Beacon or equal No. 13 for pipe sizes through 6in. and Beacon or equal No. 3 for pipe sizes larger than 6 in. Where piping insulated, escutcheons shall fit around outside of insulation.

AI. Openings:

1. Except where specifically indicated on Drawings, openings for piping for equipment will not be allowed in any structural members without written consent of Owner. For openings through concrete construction, install sleeves in forms before concrete is placed.
2. In the event additional openings are required through structural members, or notching, boring or cutting of the structure is necessary, perform the work as directed in writing by Owner.
3. Include all costs for cutting of holes required for installation of work.

AJ. Waterproofing: Make absolutely watertight all openings through waterproofed construction caused by the penetration of mechanical work.

AK. Thrust blocks: Provide thrust blocks at vertical and horizontal underground pipe locations, such as branch tees, directional changes, and where required to prevent the

separation of mechanical type pipe joints in accord with recommendations of AWWA and DIPRA (Ductile Iron Pipe Research Association).

AL. Pipe detection tracing:

1. Provide wire tracing for all underground non-metallic piping systems.
2. Copper tracer wire shall be #14 AWG solid, single conductor, insulated copper wire. Place in pipe trench above the pipe at maximum depth of 3ft. Do not secure to the pipe.
3. Terminate at each building near pipe entrance. Rise through conduit to weatherproof junction box mounted on building wall. Label box "Tracer Wire" with name of service.

AN. Below ground piping installation: In accord with manufacturer's recommendations

AO. All branch take-offs shall be from the top of water main run.

P. All air handling condensate drain piping shall be 3/4 in minimum size and shall have a union installed within 2 ft. of outlet and drain pan.

3.02 PREINSULATED CONDUIT INSTALLATION

- A. Install in accord with manufacturer's instructions and under direct supervision of manufacturer's field installation specialist employed by manufacturer and have at least 5 yr. of field piping installation experience. Credentials shall be submitted to Owner for approval.

3.03 SEISMIC BRACING AND ANCHORAGE

- A. Seismic bracing and anchorage of piping shall be done in accord with "Guidelines for Seismic Restraining of Mechanical Systems," latest edition, published by SMACNA, and in compliance with local codes.

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers.
- B. Duct access doors.
- C. Duct test holes.
- D. Flexible duct connections.
- E. Volume control dampers.

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2009.
- B. NFPA 92A - Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences; 2009.
- C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- D. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- E. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including
- F. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
- D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

1.05 PROJECT RECORD DOCUMENTS

- A. Record actual locations of access doors and test holes.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

1.08 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements, for additional provisions.
- B. Provide two of each size and type of fusible link.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:

1. Krueger;
2. Ruskin Company;
3. Titus;
4. Substitutions: Not permitted.

2.02 BACKDRAFT DAMPERS

- A. Manufacturers:
 1. Louvers & Dampers, Inc; www.louvers-dampers.com.
 2. Nailor Industries Inc; www.nailor.com.
 3. Ruskin Company; www.ruskin.com.
 4. Substitutions: Not permitted.
- B. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.04 DUCT ACCESS DOORS

- A. Manufacturers:
 1. Nailor Industries Inc; www.nailor.com.
 2. Ruskin Company; www.ruskin.com.
 3. SEMCO Incorporated; www.semcoinc.com.
 4. Substitutions: Not permitted.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
 1. Less Than 12 inches Square: Secure with sash locks.
 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
 4. Larger Sizes: Provide an additional hinge.
- D. Access doors with sheet metal screw fasteners are not acceptable.

2.05 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.07 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
 - a. Net Fabric Width: Approximately 2 inches wide.
 2. Metal: 3 inches wide, 24 gage thick galvanized steel.
- C. Lead Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.09 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 1. Louvers & Dampers, Inc; www.louvers-dampers.com.
 2. Nailor Industries Inc; www.nailor.com.
 3. Ruskin Company; www.ruskin.com.

- 4. Substitutions: Not permitted.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. Splitter Dampers:
 - 1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
 - 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 - 3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .
- D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame
- F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- G. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 22 05 48.
- J. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.
- K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- L. Use splitter dampers only where indicated.

- M. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00 - Air Terminal Units.
- N. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 234000 - HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disposable panel filters.
- B. Filter frames.
- C. Filter gages.

1.02 RELATED REQUIREMENTS

- A. Not Applicable.

1.03 REFERENCE STANDARDS

- A. AHRI 850 - Performance Rating of Commercial and Industrial Air Filter Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2004.
- B. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

- A. Conform to AHRI 850 Section 7.4.
 - 1. Dust Spot Efficiency: Plus or minus 5 percent.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.
- E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

1.06 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

- A. Farr:
- B. AAF International/American Air Filter: www.aafintl.com.
- C. Airguard:
- D. Substitutions: Not permitted.

2.02 DISPOSABLE PANEL FILTERS

- A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
- B. Performance Rating:
 - 1. Face Velocity: 500 FPM.
- C. Holding Frames: 20 gage minimum galvanized steel frame with expanded metal grid on outlet side and steel rod grid on inlet side, hinged with pull and retaining handles.

2.03 FILTER FRAMES AND HOUSINGS

- A. General: Fabricate filter frames and supporting structures of 16 gage galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.
- B. Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for 24 x 24 inches filter media, minimum 2 inches thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.
- C. Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 16 gage galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extruded aluminum tracks or channels for primary secondary filters with positive sealing gaskets.

2.04 FILTER GAGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. H.O. Trerice Co: www.trerice.com.
 - 3. Weiss Instruments: www.weissinstruments.com.
 - 4. Substitutions: Not permitted.
- B. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0-2.0 inch WG, 2 percent of full scale accuracy.
- C. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3 inch WG, 3 percent of full scale accuracy.
- D. Accessories: Static pressure tips with integral compression fittings, 1/4 inch aluminum tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install air cleaning devices in accordance with manufacturer's instructions.
- B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.
- D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- E. Provide filter gages on filter banks, installed with separate static pressure tips upstream and downstream of filters.

END OF SECTION

SECTION 260510 – ELECTRICAL BASIC REQUIREMENTS AND METHODS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work in this section.
- B. Refer to Division 16, Electrical, as well as the Specifications for the other various trades and materials and be thoroughly familiar with all provisions regarding electrical work.

2.01 BIDDING REQUIREMENTS AND RESPONSIBILITIES

- A. Prime bidder is responsible for all work, of all trades and sub-contractors bidding this project. It is the prime bidder's responsibility, prior to submitting a bid to ensure that sub-contractors coordinate all aspects of the work between trades, sub-contractors, etc. to the fullest extent possible.
- B. Prime bidder shall ensure that all sub-contractors, suppliers, equipment vendors, etc., obtain all necessary and pertinent contract document information pertaining to their work prior to the submission of a bid. Contractor shall realize that different sub-contractors may furnish equipment, accessories, devices, etc. necessary for a complete and working installation that require provision of services by another sub-contractor or trade.
- C. Bidders of all or any portions of this section or division are required to review all contract documents including but not limited to Architectural drawings, Structural drawings, Mechanical drawings, Plumbing drawings, Electrical drawings, etc. to coordinate requirements and responsibilities with and through prime bidder.
- D. Bidders of all or any portions of this section or division, by furnishing a bid on a portion of the prime contract are indicating that they have received all contract documents and coordinated services provided under their portion of the work with the prime bidder; they are indicating that they have expressed any pertinent questions (which would result from a detailed, thorough review of the entire set of contract documents) to the prime bidder in accordance with Division 1 requirements, prior to bidding.
- E. All timely, pertinent, questions provided in writing prior to bids, in accordance with Division 1 requirements, will be clarified, defined, or otherwise explained in a written addendum and/or addendums prior to bids, in accordance in Division 1 requirements.
- F. It is not the intention of these contract documents to leave any issue relating to coordination between trades or sub-contractors vaguely defined. The intention is to define all issues, coordination matters, equipment requirements, sizes, routing, etc. to the satisfaction of the prime bidder, prior to receipt of bids.
- G. Bidders of all or any portions of this section or division, by virtue of the submission of a bid to the prime bidder, are indicating that they have reviewed the entire set of contract documents with due diligence and regard for the Owner's desire for a comprehensive and complete bid proposal; that they have expressed all concerns or questions requiring clarification on matters of coordination between trades and/or sub-contractors; that they have expressed any such concerns or questions in writing in accordance with Division 1 requirements.

- H. Prime bidders, by submission of a comprehensive bid on the project are indicating that the subcontractors selected in their bid have complied with all Division 1 requirements, that they have indicated in writing, prior to bidding, all questions or concerns requiring clarification and/or explanation and have documented any and all specific exclusions involving work that would generally be considered to be work of their trade. The prime bidder shall coordinate all work so that anything excluded by the bidder of all or any portions of this section or division, have been addressed prior to bids in one of the following manners:

1. The work has been confirmed, by the prime bidder, to be work of another trade or subcontractor (whose proposal is also being accepted).
2. Clarification of the matter has been made through the prime design professional via written addendum and is clearly and mutually understood by the prime bidder and the party raising the issue/question, or seeking clarification.
3. The work has been accepted as the responsibility of the prime contractor directly.

3.01 WORK INCLUDED

- A. Provide all labor, materials, equipment, fees, licenses, and services to complete and coordinate all electrical work with Architect, suppliers, subcontractors, inspectors, and utility authorities, as indicated on the drawings, as specified herein or both except as for items specifically indicated as "NIC ITEMS".

4.01 MATERIAL AND EQUIPMENT

- A. The term "provide" when used in the Contract Documents includes all items necessary for the proper execution and completion of the Work.
- B. Specific reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect expressed in writing is equal to that specified.
- C. Coordinate and properly relate all Work of this Division to building structure and work of all other trades.
- D. Visit premises and become thoroughly familiar with existing conditions; verify all dimensions in field. Advise Architect of any discrepancies prior to Bid Date in accordance with Division 0.
- E. Do not rough-in for any item or equipment furnished by others or noted "Not in Contract" (NIC), without first receiving rough-in information or determining rough-in requirements from other trades and/or Architect.
- F. Provide storage and protection for all equipment and materials in accordance with requirements of Division 0 and Division 1. Replace any equipment and materials damaged by improper handling, storage, or protection, at no additional cost to Owner.
- G. Keep premises clean in accordance with requirements of Division 0 and Division 1.

5.01 DEFINITIONS

- A. Provide: Furnish, install and connect complete.

- B. The Drawings shall not be construed as shop drawings. In the event of a possible interference with piping or equipment of another trade, items requiring set grade and elevations shall have precedence over other items. Should any major interference develop, immediately notify the Architect.
- C. Review of shop drawings: A service by the Engineer to reduce the possibility of materials being ordered which do not comply with Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. When an error is not detected, this does not grant the Contractor permission to proceed in error.
- D. Wiring: Wire and cable, installed in raceway with boxes, fittings, connectors and supports.
- E. Work: Materials completely installed.

6.01 **REFERENCES**

- A. Refer to Division 1 for temporary electrical service and temporary construction lighting.

7.01 **DRAWINGS AND SPECIFICATIONS**

- A. The Electrical Drawings are schematic in nature and are not intended to show the exact location of conduit, outlets, etc.
- B. The Drawings and Specifications shall both be considered as part of the Contract. Any work or material shown in one and omitted in the other, or which may fairly be implied by both or either, shall be provided in order to give a complete job.
- C. Should conflicts exist between the Drawings and Specifications, the Contractor shall ask for clarification prior to doing and conflicting work.
- D. Refer to the architectural, structural, plumbing, sprinkler and HVAC plans and details for dimensions, and fit the work to conform to the details of building construction. The right is reserved to shift any switch, receptacle, ceiling outlet or any special outlet a maximum of 10'-0" from its location as shown before it is permanently installed, without incurring additions to the contract.

8.01 **CODES AND REGULATIONS**

- A. Comply with the following codes, regulations, and laws:
 - 1. National Electric Code with local attachment (year adopted by the local authority)
 - 2. National Fire Protection Code (years and chapters as adopted by the state and local codes).
 - 3. American National Standards Institute
 - 4. Americans with Disabilities Act of 1990
 - 5. Florida Building Code
 - 6. All other applicable codes and standards including the requirements of local utilities companies.
- B. Equipment shall conform to requirements and recommendations of the National Bureau of Fire Underwriters and National Fire Protection Association (NFPA).

- C. Items provided under this Division shall comply with the American National Standards Institute (ANSI) "Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People," ANSI A 117.1, and the Americans with Disabilities Act (A.D.A.).
- D. Work called for in these Plans and Specifications shall be executed by competent workmen.
- E. In the possible event of conflict between codes or regulations and Contract Documents, notify the Architect/Engineer immediately.
- F. The drawings show approximate locations only of feeders, branch circuits, outlets, etc., except where specific routing or dimensions are indicated. The Architect reserves the right to make reasonable changes in locations indicated, before roughing-in, without additional cost to the Owner.

9.01 FEES, PERMITS, AND TAXES

- A. Obtain and pay for permits required for the Work of this Division. Pay fees in connection therewith, including necessary inspection fees.
- B. Pay any and all taxes levied for Work of this Division, including municipal and/or state sales tax where applicable.

10.01 MANUFACTURER'S DIRECTIONS

- A. Install and operate equipment and material in strict accord with manufacturer's installation and operating instructions. The manufacturer's instructions shall become part of the Contract Documents and shall supplement Drawings and Specifications.

11.01 PROJECT COORDINATION

- A. Refer to applicable Division 26 Sections for products work of this Division.
- B. Refer to Division 23 for related products affecting work of this section.
- C. Coordinate handling of all products, materials, etc., through general contractor. Coordinate space, access, clearances, etc., through general contractor prior to preparation of shop drawing submittal.

12.01 PROJECT RECORD DOCUMENTS

- A. During construction period, keep accurate records of installations made under this Division, paying particular attention to major interior and exterior underground and concealed piping, ductwork, etc.

PART 2 - PRODUCTS

1.01 STANDARDS

- A. All material shall be new and shall conform to the applicable standard or standards where such have been established for the particular material in question.

- B. Material of the same type shall be the product of one manufacturer.
- C. U.L. listed material shall bear U.L. Label.

2.01 CONCRETE

- A. Provide 3000 psi concrete for all Division 16 applications including transformer and switchboard housekeeping pads.

3.01 PLYWOOD

- A. Interior Applications:
 - 1. Fire-retardant-treated plywood with a flame spread of 25 or less identified as "Interior Type A".
- B. Exterior Applications:
 - 1. Fire-retardant-treated plywood with a flame spread of 25 or less identified as "Exterior".

4.01 EQUIPMENT LABELS

- A. Panelboards, safety switches, equipment cabinets, motor starters and other equipment shown on the drawings and furnished and/or installed under this section of the Specifications shall be labeled with laminated plastic nameplates inscribed to identify equipment with description shown on the drawings for panels, the name of the equipment controlled for motor starters or the system or function involved for other equipment. Nameplates shall be white with black etched letters. Provide typewritten panelboard directories indicating the equipment served, final approved room numbers, etc., as shown on the Plans or as directed by the Architect.

PART 3 - EXECUTION

1.01 VISIT TO SITE

- A. Prior to submitting proposal, visit the site and become familiar with the conditions relating to Division 16000 work.
- B. No allowances will be made for lack of knowledge of existing conditions.

2.01 TRENCHING AND BACKFILLING

- A. All trenching, backfilling and compaction requirements shall be in accordance with other sections of these specifications.
- B. Provide excavating and backfilling necessary for Work of this Division. Comply with provisions of Division 2, Site Work, if applicable.
- C. Trenches shall be inspected by Code Authorities and/or Owner's Representative before and after piping is laid. Give Owner's Representative 24-hour notice for each inspection. If any trenches are filled without Owner's Representative inspection and as subsequently found to be deficient, the trenches shall be uncovered, inspected, and then refilled, if requested by Owner's Representative.

- D. Provide minimum 24 inches of cover to finish grades or paving at raceways.
- E. Protect and maintain trenches in dry condition until piping has been inspected and approved. Immediately after approval, backfill trenches in tamped layers. Repeat backfill and tamping 6 months after initial coverage has been accomplished to avoid swale development from sinking soils.
- F. Compact fill to satisfaction of Architect and/or Owner's Representative.
- G. Trench excavation in excess of 5 feet deep shall comply with OSHA Standard 29 C.F.R.s. 1926.650 Subpart P.

3.01 **CUTTING AND PATCHING**

- A. Comply with requirements of Division 0 and Division 1 regarding cutting and patching. Locate and timely install sleeves as required to minimize cutting and patching.
- B. Cutting, fitting, repairing, patching, and finishing of Work shall be done by craftsmen skilled in their respective trades. Where cutting is required, cut in such a manner as not to weaken structure, partitions, or floors. Holes required to be cut must be cut or drilled without breaking out around the holes. Where patching is necessary in finished areas of the building, the Architect will determine the extent of such patching and refinishing.
- C. Repairing Roadways and Walks: Where this contractor cuts or breaks roadways or walks to lay the piping, he shall repair or replace these sections to match existing, unless specifically identified as the responsibility of others.

4.01 **PAINTING**

- A. Painting shall be provided under Division 9, unless specified otherwise. Leave exposed piping, materials, and equipment clean and free of rust, grease, dirt, etc. before and after painting.
- B. Factory finished equipment, fixtures, and materials which are marred, chipped, scratched, or otherwise unacceptable shall be repaired or replaced under this Division to Architect satisfaction, at no additional cost to Owner.
- C. Coordinate all painting requirements with prime bidder prior to bids. **All** exposed conduit, materials, hangers, anchors, etc., are to be primed and painted. Color shall be to match adjacent surfaces where not specifically designated otherwise. All galvanized materials shall be suitably treated prior to painting to ensure adhesion.

5.01 **EXISTING CONDITIONS**

- A. The Electrical Contractor shall visit the building site to determine existing conditions and will be held responsible for allowing for these conditions in his bid.
- B. Note that this area of work will have storm drainage, mechanical and electrical utilities located underground and within and under the buildings. It is part of this work for the Electrical Contractor to determine the scope and location of all utilities to be installed with this project and arrange his work around others. There will be no extra consideration for work discovered as being hidden after the bid, and no change orders for extra cost that may be caused by unknown after bid conditions. The drawings show approximate locations only of feeders, branch circuits, outlets, etc., except where specific routing or dimensions are indicated. The Architect reserves

the right to make reasonable changes in locations indicated, before roughing-in, without additional cost to the Owner.

6.01 PROTECTION OF APPARATUS

- A. The Electrical Contractor shall take precautions necessary at all times to properly protect his apparatus from damage. Failure on the part of the Contractor to comply with the above to the Architect's satisfaction shall be sufficient cause for the rejection of the particular piece of apparatus in question.

7.01 DELIVERY, HANDLING, PROTECTION OF MATERIALS AND STORAGE

- A. Ship, deliver and store products in the manufacturer's protective packing to prevent damaging.
- B. Handle equipment carefully to prevent damage to components, breakage and denting or scoring of surfaces and finishes.
- C. Store all equipment and products in clean, dry spaces. Protect all equipment from dirt, fumes, water, chemicals, construction debris and physical damage. Any equipment exposed directly to moisture will not be acceptable and shall be replaced.
- D. Replace damaged products and equipment. Repair and repaint marred and damaged finishes to original factory finish as directed by manufacturer and as herein specified.
- E. Keep all conduit and other openings protected against entry of foreign matter.

8.01 COORDINATION

- A. Prior to rough-in of any materials, coordinate with other subcontractors the physical clearances for the sequencing of Division 16000 work as it interfaces with and relates to Civil, Architectural, Structural, Plumbing, Sprinkler and HVAC systems.
- B. Coordinate and verify power company service requirements prior to bid. Bid to include all work required.
- C. Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised at the expense of the Contractor and without incurring additions to the Contract.

9.01 CODES AND REGULATIONS

- A. In the event of a conflict between codes, the more restrictive code shall apply.
- B. Other codes and regulations as referenced herein after in this specification are applicable to this Section.

10.01 PERMITS AND INSPECTIONS

- A. Secure and pay for all division 16000 permits, fees, licenses and inspections.

11.01 STANDARDS FOR MATERIALS AND WORKMANSHIP

- A. Use materials that are new and, where U.L. has established standards, U.L. listed and labeled.

- B. Organize and execute work so that finished appearance is neat; plumb when vertical and level when horizontal.

12.01 COORDINATION OF TRADES

- A. Where work is in close proximity to the work of other contractors, the Electrical Contractor shall review plans of other contractors and coordinate his work with theirs. The Electrical Contractor shall verify the location of lighting fixtures, beams, structural members, conduit, ductwork, pipes or other obstructions before beginning his work in the area. Notify the Architect where proper clearances do not occur or where the work of others would interfere with the safe and/or proper operation of this work.

13.01 PRODUCT SUBSTITUTIONS

- A. The Contract for construction shall be based upon products and standards established in the Contract Documents without consideration of proposed substitutions.

14.01 SUPPORTS AND FOUNDATIONS

- A. Support all items covered by this Specification directly from building structural members independent of any ceilings or any other installed item. Panelboards and switches may be attached to suitably reinforced walls. Ground or slab mounted equipment to be mounted on a separate four inch high concrete slab.
- B. Do not attach items of this Specification to HVAC ductwork, ceiling grids and ceiling support members, piping or other equipment unless specifically shown otherwise. Where applicable, all equipment including conduit is to be supported from overhead wall, floor or roof structures using galvanized channel or angle members for a rigid support. Position supports and equipment such that access through lay-in ceilings or panels is not impaired and all Code required clearances are maintained.
- C. Where applicable, under no circumstances is the Electrical Contractor to attach to or support from any bar joist bridging. Any supports to the bar joists or any structural systems are to be approved by the Architect. All supplemental angle or channel iron required to support equipment of this Specification is to be furnished by the Electrical Contractor.

15.01 EQUIPMENT LAYOUT

- A. The physical location and arrangements of electrical equipment is shown on the Plans and is to be used by the Electrical Contractor as a guideline in construction. It is the responsibility of the Electrical Contractor to review the Plans with the proposed equipment and equipment of other contractors that are affected, and to insure that all Code required clearances, wiring distances and maintenance accesses, including equipment heights, of all items are maintained. The contractor is to provide a 1/4 inch scaled drawing showing all equipment, including those of other contractors. Include shop drawing cut sheets and applicable information. Indicate on the drawing by dimension all required Code clearances, wiring distances and maintenance access requirements. Where equipment heights are required to be coordinated with architectural or other items, indicate revised heights. Alternate arrangements to accomplish the above due to field conditions or changes in physical size of the equipment proposed for the project are to be submitted to the Architect for review before any work is begun or equipment ordered.

16.01 GUARANTEE

- A. The Contractor shall guarantee all materials, equipment and workmanship for a period of one (1) year from the date of final acceptance of the project. This guarantee shall include furnishing of all labor and material necessary to make any repairs, adjustments or replacement of any equipment, parts, etc. necessary to restore the project to first class condition. This guarantee shall exclude only the changing of lamps. Warranties exceeding one (1) year are hereinafter specified with individual pieces of equipment.
- B. If the Contractor's office is in excess of a fifty (50) mile radius of the project, he shall appoint a local qualified contractor to perform any emergency repairs or adjustments required during the guarantee period. The name of the contractor appointed to provide emergency services shall be submitted to the Architect for his approval.

17.01 CLEANING

- A. Clean all light fixtures, lamps and lenses prior to final acceptance. Replace all inoperative lamps.

18.01 PROHIBITION OF ASBESTOS AND PCB

- A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound or material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.

END OF SECTION

SECTION 260519 - LOW VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire and cable for 600 volts and less.
- B. Wiring connectors and connections.
- C. Multiconductor cables and terminations.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

- A. Concealed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN/THWN insulation in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.
- B. Exposed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN/THWN insulation in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.
- C. Above Accessible Ceilings: Use only building wire in raceway, building wire with Type THHN/THWN insulation in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.
- D. Wet or Damp Interior Locations: Use only building wire with Type XHHW-2 insulation in raceway, direct burial cable, armored cable with jacket, or metal clad cable.
- E. Exterior Locations: Use only building wire with Type XHHW-2 insulation in raceway, direct burial cable, service-entrance cable, armored cable with jacket, or metal clad cable.
- F. Underground Installations: Use only building wire with Type XHHW-2 insulation in raceway, direct burial cable, service-entrance cable, armored cable, or metal clad cable.
- G. Use stranded conductors for feeders and branch circuits 10 AWG and smaller.
- H. Use stranded conductors for control circuits.
- I. Use conductor not smaller than 12 AWG for power and lighting circuits.
- J. Use conductor not smaller than 14 AWG for facility motor and lighting control circuits.
- K. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- L. Conductor sizes are based on copper unless indicated as aluminum or "AL".

2.02 WIRE AND CABLE MANUFACTURERS

- A. Cerro Wire Inc: www.cerrowire.com.
- B. Industrial Wire & Cable, Inc: www.iewc.com.
- C. Southwire Company: www.southwire.com.
- D. American Insulated Wire Corporation: www.aiwc.com.
- E. Houston Wire and Cable Company: www.houwire.com.
- F. Alcan Cable: www.cable.alcan.com.
- G. Substitutions: Not permitted.

2.03 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor:
 - 1. For Sizes Smaller Than 1/0 AWG: Copper.
 - 2. For Sizes 1/0 AWG and Larger: Copper or Aluminum as noted on drawings.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, Type THHN/THWN or XHHW-2.

2.05 WIRING CONNECTORS

2.06 LOW VOLTAGE SPLICES (POWER CABLES)

- A. Cold shrink splices meeting requirements of ANSI C119-1 for splices rated up to 1000 volts. Splice shall form a moisture tight seal and shall be located in semi-dry areas.
 - 1. Product: 3M 8420 series or QSLV series.

2.07 LOW VOLTAGE MULTICONDUCTOR CABLES

- A. Low Voltage Cable Manufacturers:
 - 1. Belden: www.belden.com.
 - 2. West Penn: www.westpenn-cdt.com.
 - 3. Alphawire: www.alphawire.com.
 - 4. TMB: www.tmb.com
 - 5. Gepco: www.gepco.com.
 - 6. Anixter: www.anixter.com.
 - 7. National Wire and Cable Co.: www.nationalwire.com.
 - 8. Okonite: www.okonite.com.
 - 9. Superior Essex: www.superioressex.com.
 - 10. Substitutions: not permitted.
- B. Multiconductor low voltage cables for systems as identified below. Designation noted in parenthesis used to identify cables on the drawings.
 - 7. Fire Alarm Cables:
 - a. Unshielded: Single twisted pair solid bare copper conductors No. 12 AWG with PVC 300V rated insulation in red PVC jacket, CSFM listed. Belden No. 9582 (.340" O.D.). NEC Class FPLR (2C#12 FPLR).
 - b. Unshielded: Single twisted pair solid bare copper conductors No. 14 AWG with PVC 300V rated insulation in red PVC jacket, CSFM listed. Belden No. 9580 (.303" O.D.). NEC Class FPLR (2C#14 FPLR).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.
- D. Verify that field measurements are as indicated.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.03 INSTALLATION

- A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Route wire and cable as required to meet project conditions.
 - 1. Wire and cable routing indicated is approximate unless dimensioned.
 - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
 - 3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.
- C. Use wiring methods indicated. Combining building wiring branch circuits or feeders into common runs from the design intent shown on the drawings is not acceptable.
- D. Pull all conductors into raceway at same time.
- E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- F. Protect exposed cable from damage.
- G. Support cables above accessible ceiling, using spring metal clips or metal or plastic cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- H. Use suitable cable fittings and connectors.
- I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- J. Clean conductor surfaces before installing lugs and connectors.
- K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise. Branch circuit conductor splicing is not allowed unless otherwise approved by Owner.
- L. Terminate aluminum conductors with lugs rated for both copper and aluminum conductors. Fill with anti-oxidant compound before installing conductor. Terminate conductors using torque wrench and tighten to connector manufacturer's published data.
- M. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- N. Use insulated mechanical connectors for copper conductor splices and taps, 6 AWG and larger.
- O. Use solderless pressure connectors with insulating covers for conductor splices and taps, 8 AWG and smaller.
- P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- Q. Use silicon filled underground direct burial type safety connectors for copper conductor splices and taps at all outdoor, wet and direct burial locations.
- R. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

3.04 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding components.
- B. Provide all components necessary to complete the grounding system(s) consisting of:
 - 1. Metal underground water pipe.
 - 2. Metal frame of the building.
 - 3. Concrete-encased electrode.
 - 4. Rod electrodes.
 - 5. Ground Bus Assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low Voltage Power Conductors and Cables..

1.03 REFERENCE STANDARDS

- A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: no greater than 5ohms.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- E. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratories (NRTL) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.03 CONNECTORS AND ACCESSORIES

- A. Mechanical Connectors: Bronze.
- B. Exothermic Connections:
 - 1. Product: Cadweld manufactured by Erico.
 - 2. Product: BurndyWeld manufactured by FCI Connect.
 - 3. Product: Furseweld manufactured by Thomas and Betts.
- C. Wire: Stranded copper.
- D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

- J. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Parallel feeders shall be provided with a ground conductor in each distinct conduit. Terminate each end on suitable lug, bus, or bushing.
- K. Ground continuity shall be maintained throughout all electrical components.

3.03 FIELD QUALITY CONTROL

- A. Provide field inspection in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

END OF SECTION

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

1.02 RELATED SECTIONS

- A. Section 07 84 13 - Firestopping: Materials and methods for work to be performed by this installer.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- D. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.02 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit. Hot dip galvanized or cadmium plated. Stainless steel or reinforced fiberglass for wet or damp locations.
- B. Supports - General: Fabricated of structural steel or formed steel members; galvanized.
 - 1. Roof top conduit supports:
 - a. Closed cell medium density black polyethylene foam, UV resistant with integral steel support channel.
 - b. Absorbs vibration and shock.
 - c. Accommodates expansion and contraction of piping.
- C. Anchors and Fasteners:
 - 2. Concrete Structural Elements: Use precast inserts.
 - 3. Steel Structural Elements: Use beam clamps.
 - 4. Concrete Surfaces: Use self-drilling anchors.
 - 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
 - 6. Solid Masonry Walls: Use preset inserts.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
 - 1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 - 2. Do not drill or cut structural members.
- B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- F. Use one or two hole straps for single conduit runs on walls or ceilings.
- G. For gangs of two or more conduits, use beam clamps attached to main steel structural support members to attach solid steel threaded rods for supporting formed steel channel trapezes. For single conduits, use hangers with solid steel threaded rods attached to main steel structural members using beam clamps.
- H. Do not penetrate with any fastenings more than 1-1/2 inches into reinforced concrete beams or more than 3/4 inch into reinforced concrete joists to prevent contact with reinforcing bars.
- J. Roof top conduit supports:
 - 1. Install supports to load rating in accord with manufacturer's instructions and at a maximum spacing of 8 feet.
 - 2. Field cutting of foam block is not acceptable.
 - 3. Channel strut shall be bonded to the foam block.
 - 4. Permanently and securely bond foam block to the roof with weather resistant adhesive or mastic that is compatible with the roofing material and has been approved by the roofing contractor.
 - 5. Wood blocks or members shall not be used to support any electrical conduits, boxes or other electrical items.

END OF SECTION

SECTION 260534 - CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 13 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems.
- E. Section 26 05 37 - Boxes.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
- D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007.
- G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association; 2003.
- I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
- J. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratory (NRTL) as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit or PVC coated conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Conduit Size: Comply with NFPA 70.
 - 1. Minimum Size: 1/2 inch unless otherwise specified.
- B. Underground Installations:

1. More than 5 Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, plastic coated conduit, or schedule 40 PVC.
 2. Within 5 Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, plastic coated conduit, thickwall nonmetallic conduit, or schedule 40 PVC.
 3. In or Under Slab on Grade: Use galvanized rigid steel conduit or schedule 40 pvc.
 4. Minimum Size: 1/2 inch.
- C. Outdoor Locations Above Grade: Use galvanized rigid steel conduit.
- D. In Slab Above Grade:
1. Use galvanized rigid steel conduit or schedule 40 pvc.
 2. Maximum Size Conduit in Slab: 3/4 inch; ____ inch for conduits crossing each other.
- E. Wet and Damp Locations: Use galvanized rigid steel conduit or Schedule 80 PVC.
- F. Dry Locations:
1. Concealed: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, or electrical metallic tubing.
 2. Exposed: Use galvanized rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, or electrical metallic tubing.

2.02 METAL CONDUIT

- A. Manufacturers:
1. Allied Tube & Conduit: www.alliedtube.com.
 2. Beck Manufacturing, Inc: www.beckmfg.com.
 3. Wheatland Tube Company: www.wheatland.com.
 4. Substitutions: Not permitted.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Rigid Aluminum Conduit: ANSI C80.5.
- D. Intermediate Metal Conduit (IMC): Rigid steel.
- E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.03 PVC COATED METAL CONDUIT

- A. Manufacturers:
1. Allied Tube & Conduit: www.alliedtube.com.
 2. Thomas & Betts Corporation: www.tnb.com.
 3. Robroy Industries: www.robroy.com.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NEMA RN 1; rigid steel conduit with external PVC coating.
- C. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick with large radius elbows.
- D. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

1. AFC Cable Systems, Inc: www.afcweb.com.
 2. Electri-Flex Company: www.electriflex.com.
 3. International Metal Hose: www.metalhose.com.
 4. Allied Tube & Conduit (Eastern): www.alliedtube.com.
 5. Substitutions: Not permitted.
- B. Description: Interlocked steel construction.
- C. Fittings: NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE CONDUIT (METALLIC & NONMETALLIC)

- A. Manufacturers:

1. AFC Cable Systems, Inc: www.afcweb.com.
 2. Electri-Flex Company: www.electriflex.com.
 3. International Metal Hose: www.metalhose.com.
 4. Allied Tube & Conduit (Eastern): www.alliedtube.com.
 5. Lamson & Sessions (Carlon): www.carlon.com.
 6. Substitutions: Not permitted.
- B. Metallic Flexible Conduit:
1. Description: Interlocked steel construction with PVC jacket.
 2. Fittings: NEMA FB 1.
- C. Nonmetallic Flexible Conduit:
1. Description: Nonconductive and noncorrosive type LFNC-B.
 2. Fittings: NEMA FB 1.

2.06 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
1. Allied Tube & Conduit: www.alliedtube.com.
 2. Beck Manufacturing, Inc: www.beckmfg.com.
 3. Wheatland Tube Company: www.wheatland.com.
 4. Substitutions: Not permitted.
- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.07 NONMETALLIC CONDUIT

- A. Manufacturers:
1. Lamson & Sessions (Carlon): www.carlon.com.
 2. Allied Tube & Conduit: www.alliedtube.com.
 3. Cantex: www.cantexinc.com.
 4. Queen City Plastics: www.queencityplastics.com.
 5. Southern Pipe Inc.: www.southern-pipe.com.
 6. Endot: www.endot.com.
 7. Substitutions: Not permitted.
- B. Description: NEMA TC 2; Schedule 40 PVC. Schedule 80 shall be UV rated.
- C. Fittings and Conduit Bodies: NEMA TC 3.
- D. Innerduct: PVC corrugated, corrosion resistant, crush resistant, highly flexible orange 1" duct with pull tape and duct plug.
1. Carlon DF4X1C-1000 duct and MAEPG2 blank plug or equivalent by Endot.

2.08 NONMETALLIC TUBING

- A. Manufacturers:
1. Beck Manufacturing, Inc: www.beckmfg.com.
 2. Cantex Inc: www.cantexinc.com.
 3. Lamson & Sessions (Carlon): www.carlon.com.
 4. Substitutions: Not permitted.
- B. Description: NEMA TC 2.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.09 CONDUIT BODIES, HUBS, FITTINGS, SEALS AND SEALING COMPOUNDS

- A. Manufacturers:
1. O-Z Gedney: www.o-zgedney.com.
 2. Hubbell-Killark: www.hubbell-killark.com.
 3. Thomas & Betts: www.tnb.com.
 4. Lamson & Sessions (Carlon); www.carlon.com.
 5. Appleton: www.appletonelec.com.

6. Cooper Crouse Hinds: www.crouse-hinds.com.
 7. Pipeline Seal & Insulator Inc. (PSI): www.linkseal.com.
 8. PRC-Desoto International Inc. (Semco): www.ppg.com/prc-desoto/.
 9. Substitutions: Not permitted.
- B. Bodies and fittings of same material as conduit.
 - C. Compressible rubber modular sealing products (i.e. Link Seal®) for all core drilled conduit penetrations through concrete or masonry to provide a watertight seal.
 - D. Expandable polyurethane foam (Semco® PR-821 by PRC-DeSoto) with density of 7 - 8 pounds per cubic foot for sealing of conduits with or without cables entering manholes, pullboxes or electrical rooms to seal against intrusion of water or gases.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

- A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install steel conduit as specified in NECA 101.
- C. Install nonmetallic conduit in accordance with manufacturer's instructions.
- D. Arrange supports to prevent misalignment during wiring installation.
- E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- F. Group related conduits; support using conduit rack. Construct rack using steel channel ; provide space on each for 25 percent additional conduits.
- G. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.
- H. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- I. Do not attach conduit to ceiling support wires.
- J. Arrange conduit to maintain headroom and present neat appearance.
- K. Route exposed conduit parallel and perpendicular to walls.
- L. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- M. Route conduit in and under slab from point-to-point.
- N. Maintain adequate clearance between conduit and piping, 6 inches minimum.
- O. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F and between any power system (nominally 110V or above) and low voltage system (nominally below 110V) conduits.
- P. Combining conduit runs or conduit homeruns for any systems from those shown on the drawings is not acceptable.
- Q. Maintain separation of EMS 300V rated cables and any power cables entering a motor controller (individually mounted or within an MCC). Do not combine cables within any wireway, box or conduit until cables have entered the controller. A transition junction box with terminal strips to convert between 300V cable and building wire is not acceptable.
- R. Cut conduit square using saw or pipecutter; de-burr cut ends.
- S. Bring conduit to shoulder of fittings; fasten securely.

- T. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- U. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.
- V. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.
- X. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- Y. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- Z. Provide polypropylene or nylon pull line in each empty conduit except sleeves (maximum 10 feet in length) and nipples. Add tag at each end identifying opposite end location.
- AA. Use suitable caps to protect installed conduit against entrance of dirt and moisture. Install caps on ends of all stubbed out underground conduits.
- AB. Ground and bond conduit under provisions of Section 26 05 26.
- AC. Identify conduit under provisions of Section 26 05 53.
- AD. Conduits containing multiconductor cables that are terminated with connectors plugged on the exterior of equipment shall terminate with a bushing no further than 6 inches and no closer than 3 inches from the equipment. These locations are as indicated on reference interconnect diagrams.
- AE. Where conduits enter an enclosure, box, panel or cabinet or other fitting through a knockout, provide locknut and bushing on inside of enclosure.
- AF. Interior conduits exiting concrete slabs:
 - 1. Extend metal conduit minimum 36 inches prior to adapting to EMT.
 - 2. Extend PVC conduit minimum 12 inches prior to adapting to metal conduit.
 - 3. Conduit entering a junction box or enclosure within 60 inches of exiting a slab shall be of the same continuous material.
 - 4. A rigid coupling flush with concrete slab shall be used to adapt to metallic conduit.
- AG. Flexible conduits:
 - 1. Metal flexible conduit for connection to equipment subject to vibration and for connection to light fixtures above suspended ceilings, maximum 6 foot lengths.
 - 2. Liquidtight flexible conduit at all damp, wet and outdoor locations.
 - 3. Non metallic flexible conduit for connections into electronic equipment racks.
- AI. Underground conduits and conduits in concrete:
 - 1. 24 inch minimum cover for underground conduits outside of building foundations.
 - 2. Concrete encasement not required for conduits outside of building foundations containing branch circuits, dimmer circuits, audio, or control cables unless indicated otherwise on drawings.
 - 3. 12 inch minimum cover for conduits under building floor slabs or under other concrete structures. Stub up risers shall be perpendicular to the horizontal at the point of entry into the bottom of the slab or structure.
 - 4. Minimum 1 inch cover for conduits in concrete slabs, walls or roof.
 - 5. Bell end bushings for conduit entries into underground manholes and pullboxes, or along side the CUTB.

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified in Section 07 52 00 (07550).

END OF SECTION

SECTION 260537 - BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Pull and junction boxes.
- C. In ground pullboxes and handholes.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 13 - Firestopping.
- B. Section 26 27 26 - Wiring Devices: Wall plates in finished areas.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007.
- C. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008.
- D. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2008.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- G. ANSI/SCTE 77 - Specification for Underground Enclosure Integrity, American National Standards Institute and Society of Cable Telecommunications Engineers.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc., or approved nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Appleton Electric: www.appletonelec.com.
- B. Thomas & Betts (Steel City and Red Dot): www.tnb.com.
- C. Hubbell (Raco and Bell): www.hubbell-raco.com.
- D. O-Z Gedney: www.o-zgedney.com.
- E. Cooper Crouse Hinds: www.crouse-hinds.com.
- F. Lamson & Sessions (Carlon): www.carlon.com.
- G. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
 - 3. Ceiling outlet boxes not less than 4 inch octagonal x 2 1/8 inch deep.

- 4. Communications outlet boxes not less than 4 11/16 inch square x 2 1/8 inch deep.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, cast fer alloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.03 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel not less than 4 inches square x 2 1/8 inch deep.
- B. Nonmetallic boxes: NEMA OS 2, PVC with hubs and gasketed covers.
 - 1. NEMA 6P with gasketed covers and stainless steel screws for outdoor direct burial locations.
 - 2. Raintight hubs on sides of outdoor above grade boxes, no top entry hubs.
 - 3. Use for underground branch circuits, lighting circuits or audio applications only.
- C. Hinged Enclosures: As specified in Section 26 27 16.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION

- A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
 - 1. Adjust box locations up to 10 feet if required to accommodate intended purpose.
 - 2. Combining pull boxes or junction boxes from those shown on the drawings is not acceptable unless code restrictions apply due to actual field conditions.
- E. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- F. Maintain headroom and present neat mechanical appearance.
- G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- I. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- K. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- L. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- M. Use flush mounting outlet box in finished areas.
- N. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening. Use square cornered type boxes or boxes fitted with rings of sufficient depth so box is wholly contained within cavity of block and no mortar is required between masonry and box.
- O. Provide separate boxes for emergency power and normal power systems.

- P. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- Q. Locate outlet boxes so that wall plates do not span different building finishes.
- R. Locate outlet boxes so that wall plates do not cross masonry joints.
- S. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation.
 - 1. Provide minimum 24 inches separation in acoustic rated walls.
 - 2. Provide minimum 24 inches separation in fire rated walls.
- T. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- U. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- V. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- W. Use adjustable steel channel fasteners for hung ceiling outlet box.
- X. Do not fasten boxes to ceiling support wires.
- Y. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- Z. Use gang box where more than one device is mounted together. Do not use sectional box.
- AA. Use gang box with plaster ring for single device outlets.
- AB. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- AC. Close unused open knockouts in interior boxes with knockout seals. Close unused screw holes in exterior boxes with stainless steel screws, nuts or washers.
- AD. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted sheet metal boxes in other locations.
- AE. In ground precast boxes: Provide a 6 inch base of compacted gravel under box extending minimum 4 inches beyond all four sides of the box.

3.03 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install plaster rings in outlet boxes in areas where concrete will be exposed after construction is complete.
- C. Install knockout closures in unused box openings.

3.04 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.
- D. Field-painted identification of conduit and junction boxes.

1.02 RELATED REQUIREMENTS

- A. Section 09 90 00 - Painting and Coating.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratory (NRTL) as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Seton Identification Products: www.seton.com/aec.
- C. Hellermann Tyton: www.hellermannityton.com.
- D. Panduit Corporation: www.panduit.com.
- E. Thomas & Betts: www.tnb.com.
- F. Ideal Industries Inc.: www.idealindustries.com.
- G. Electromark: www.electromark.com.
- H. Substitutions: Not permitted.

2.02 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, white letters on black background for equipment that is not powered by an emergency system and white letters on a red background for equipment that is powered by an emergency system and black letters on a yellow background for equipment that is optional standby. Outdoor nameplates shall be UV resistant.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Contactor cabinets.
 - 3. Audio and Video Breakout Boxes.
- C. Letter Size:
 - 1. Use 1/4 inch letters for identifying individual equipment and loads.
 - 2. Use 3/8 inch letters for identifying grouped equipment and loads.
- D. Labels: Embossed adhesive tape, with 1/8 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, and source circuit designation on front of wireways and pullboxes.
 - 1. Install arc flash warning labels on switchboards, distribution boards, branch circuit panelboards, control panels and motor control centers.

2. Install label on each switchboard, distribution board, branch circuit panelboard or motor control center identifying system voltage and conductor phase color coding within.
3. Install designation label for each relay or contactor within control or contactor cabinets.
4. Install caution label on control panels or branch circuit panelboards with integral control compartments. Label shall be red with white letters reading "Caution, external control voltage circuit within this panel".
5. Install "from and to" identifier label at each underground conduit's stubup location.
6. Install warning label on contactor cabinets reading "Warning, this cabinet energized from more than one source".

2.03 WIRE MARKERS

- A. Description: Vinyl cloth type self-adhesive wire markers.
- B. Description: tape or split sleeve type wire markers.
- C. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.
- D. Legend:
 1. Power and Lighting Circuits: Branch circuit (includes source panel and circuit number) or feeder identification indicated on drawings. Branch circuit wire markers identifying both source panel and circuit number are not required at locations where the conductor is within a panel or within an adjacent wireway connected directly to a panel through short nipple conduits (i.e. dimmer cabinets). At these locations a circuit number marker only is acceptable.
 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.04 WIREWAY, JUNCTION BOX AND PULLBOX COVER CIRCUIT MARKERS

- A. Identify with corresponding circuit designation on outside of wireways, junction boxes and pullboxes. Labels shall be installed on side of box if box is located such that it is visible to guests. Otherwise, install labels on cover.
- B. For identification of wireways, junction boxes and pullboxes, use 1/4 in. height lettering, P-Touch type, laminated, self-sticking tape markers such as Brother PT-1200.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

- A. Install nameplates and labels parallel to equipment lines.
- B. Secure nameplates to indoor equipment front using rivets. Outdoor nameplates to be secured using approved adhesive.
- C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Identify conduit and junction boxes using field painting under provisions of Section 09 90 00.
 1. Paint colored band on each fire alarm system conduit longer than 6 feet.
 2. Paint bands 20 feet on center.
 3. Colors:
 - a. Fire Alarm System: Red.

END OF SECTION

SECTION 260919 - ENCLOSED CONTACTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General purpose contactors.
- B. Lighting contactors.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- B. Section 26 05 53 - Identification for Electrical Systems: Engraved nameplates.
- C. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

- A. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- B. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association; 2000.
- C. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).
- D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide dimensions, size, voltage ratings and current ratings.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. GE Industrial: www.geindustrial.com.
- F. Siemens: www.siemens.com.
- G. Substitutions: Not permitted.

2.03 LIGHTING CONTACTORS

- A. Description: NEMA ICS 2, magnetic lighting contactor.
- B. Configuration: Mechanically held, 3 wire control or electrically held as noted on drawings.
- C. Coil operating voltage: 120 volts, 60 Hertz.

- D. Poles: As required to match circuit configuration and control function.
- E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.
- F. Enclosure: NEMA ICS 6, Type 1.
- G. Accessories:
 - 1. Selector Switch: ON/OFF/AUTOMATIC.
 - 2. Indicating Light: Transformer, LED, 6V, push to test type, color as indicated on drawings.
 - 3. Auxiliary Contacts: Two, normally open.

2.04 ACCESSORIES

- A. Auxiliary Contacts: NEMA ICS 2, 2 field convertible contacts in addition to seal-in contact.
- B. Cover Mounted Pilot Devices: NEMA ICS 5, heavy duty type.
- C. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
- D. Indicating Lights: Transformer, LED, 6V, push to test type, color as indicated on drawings.
- E. Selector Switches: Rotary type.
- F. Relays: NEMA ICS 2, see section 26 09 16 (13801), Electric Controls and Relays.
- G. Control Power Transformers: 120 volt secondary, 100 VA minimum, in each enclosed contactor. Provide fused primary and secondary, and bond unfused leg of secondary to enclosure.

2.05 DISCONNECTS

- A. Combination Contactors: Combine contactor with disconnect in common enclosure.
- B. Disconnects: Thermal magnetic circuit breaker with integral thermal and instantaneous magnetic trip in each pole; UL listed.
- C. Disconnects: Fusible switch assembly; NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 05 29.
- C. Height: 5 ft to operating handle.
- D. Provide fuses for fusible switches; refer to Section 26 28 13 for product requirements.
- E. Provide engraved plastic nameplates; refer to Section 26 05 53 for product requirements and location.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform applicable inspections and tests listed in NETA STD ATS, Section 7.16.1.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Nameplates.
- E. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision D, 2006.
- B. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- F. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- G. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2006.
- H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- I. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- L. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- M. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- O. UL 67 - Panelboards; Current Edition, Including All Revisions.
- P. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- Q. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- R. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- S. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Owner of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 1. Include characteristic trip curves for each type and rating of overcurrent protective device.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 2. Panelboard Keys: Two of each different key.
 3. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric (Square D): www.squared.com.
- D. Siemens: www.sbt.com.
- E. Substitutions: Not Permitted.

2.02 ALL PANELBOARDS

- A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 3. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 4X, stainless steel.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.

- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.
- L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- N. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- O. Load centers are not acceptable.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Aluminum.
 - 3. Ground Bus Material: Aluminum.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard ; provide insulated ground bus where indicated on drawings.
- G. Minimum Integrated Short Circuit Rating: As indicated.
- H. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
 - 4. Do not use tandem circuit breakers.
- J. Enclosure: NEMA PB 1, Type 1.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Switches:
 - 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - 2. Fuse Clips: As required to accept indicated fuses.

- a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- 4. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- B. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - b. Provide interchangeable trip units where indicated.
 - 6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 7. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
 - e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
 - 10. Do not use tandem circuit breakers.
 - 11. Do not use handle ties in lieu of multi-pole circuit breakers.
 - 12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

2.06 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

2.07 SURGE PROTECTIVE DEVICES

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 05 29.
- E. Install panelboards plumb.
- F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide grounding and bonding in accordance with Section 26 05 26.
 - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
 - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- J. Install all field-installed branch devices, components, and accessories.
- K. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- N. Set field-adjustable circuit breaker tripping function settings as directed.
- O. Set field-adjustable ground fault protection pickup and time delay settings as directed.
- P. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- Q. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- R. Provide concrete housekeeping pads for panel boards extending to the floor under the provisions of Section 03 30 00. Provide 3 1/2" thick concrete pad, extend at least 2" beyond all sides, front and back of the equipment except where equipment extends to walls.
- S. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- T. Provide filler plates to cover unused spaces in panelboards.
- U. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated.
- V. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.
- W. Provide identification nameplate for each power distribution panelboard branch device in accordance with Section 26 05 53, clearly and specifically indicating the loads served.
- X. Provide arc flash warning labels in accordance with NFPA 70.
- Y. Provide floor markings to clearly indicate required working clearances where required by the authority having jurisdiction.
- Z. Ground and bond panelboard enclosure according to Section 26 05 26.

3.03 FIELD QUALITY CONTROL

- A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Fusible Switches: Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.1.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- I. Correct deficiencies and replace damaged or defective panelboards or associated components.
- J. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers in power distribution panelboards.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.
- C. Set adjustable circuit breakers with trips as indicated.

END OF SECTION

SECTION 262717 - EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 34 - Conduit.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).
- C. Section 26 05 37 - Boxes.
- D. Section 26 05 53 - Identification for Electrical Systems.
- E. Section 26 27 26 - Wiring Devices.
- F. Section 26 28 18 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- C. ANSI/UL 418 - Standard for Safety of Cord Sets and Power Supply Cords..
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

1.05 COORDINATION

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Conform to NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 26 28 18.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Flexible Conduit: As specified in Section 26 05 34.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 37.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Motion switching sensors.
- C. Wall dimmers.
- D. Receptacles.
- E. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 37 - Boxes.
- B. Section 26 05 53 - Identification for Electrical Systems: Labels for wiring devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- E. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- F. ANSI/UL 498 - Standard for Attachment Plugs and Receptacles.
- G. W-C-596 - General Specification for Electrical Power Connectors, Federal Specification of the General Services Administration.
- J. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- K. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- L. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- M. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.02 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes: **White, unless otherwise indicated.**

2.03 WALL SWITCHES

- A. All Wall Switches: AC only, quiet operating, general-use **rocker switches, unless otherwise indicated**, with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Wall Switches: AC only general-use **rocker switch**, complying with NEMA WD 6 and WD 1, side wired.
 - 1. Body and Handle: **White** plastic with **rocker** handle unless otherwise noted on drawings.
 - a. Colored device bodies are required in specific guest accessible areas as designated by owner. Coordinate color selection with owner prior to ordering devices.
 - 2. Ratings:
 - a. Voltage: 120 volts, AC.
 - b. Current: 15 amperes.
- C. Switch Types: Single pole, double pole, 3-way, 4-way, SPDT momentary contact, three position, and center off.

2.06 RECEPTACLES

- A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- B. Receptacles: Federal specification duty, complying with NEMA WD 6 and WD 1, side wired. Straight blade receptacles shall comply with UL 498. General use straight blade receptacles as identified by UL 498 are not acceptable.
 - 1. Device Body: **White** plastic unless otherwise noted on drawings.
 - a. Colored device bodies are required in specific guest accessible areas as designated by owner. Coordinate color selection with owner prior to ordering devices.
 - 2. Configuration: NEMA WD 6, type as specified and indicated.
 - 3. Single Convenience Receptacles: Type as specified on drawings.
 - 4. Duplex Convenience Receptacles: Type 5-15R.
- C. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Faceless GFCI device with test / reset buttons at locations noted on drawings.
- F. Product: Single RJ11 flush mount type phone jack.

2.07 WALL PLATES

- A. All Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Decorative Cover Plates: **White**, smooth plastic unless noted otherwise on drawings.
- C. Exterior Weatherproof Covers:
 - 1. Die cast aluminum with hinged cover rated for respective type of use as follows:
 - a. Outlet box weatherproof hoods: NEMA 3R, gasketed, for unattended use with cover closed, padlockable latching cover to meet OSHA lockout/tagout requirements with large cord opening.
 - b. Low profile weatherproof covers: Gasketed, approved for use with cover open, self closing hinged cover (two independent lids for duplex receptacles which are horizontally mounted).

- c. Communication outlet weatherproof hoods: NEMA 3R for unattended use with cover closed, two cord openings.
- 2. Safety receptacles in guest accessible areas with low profile weatherproof metal covers.
- 3. GFCI receptacles with weatherproof metal hoods.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that core drilled holes for poke-through assemblies are in proper locations.
- H. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.
- B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of wiring devices provided under this section.
 - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 - 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

- I. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- K. Install wall switches with OFF position down.
- L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- M. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- Q. Install identification label for wall switches and wall dimmers in accordance with Section 26 05 26 indicating load served when controlling loads that are not visible from the control location or multiple wall switches or wall dimmers are installed at one location.
- R. Install identification label for all receptacles in accordance with Section 26 05 26 indicating serving branch circuit.
- S. Install poke-through closure plugs in all unused core holes to maintain fire rating of floor.
- T. Install receptacles with grounding pole on top.
- U. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- V. Install decorative colored cover plates on switch, receptacle, and blank outlets in finished areas.
- W. Connect wiring devices by wrapping conductor around screw terminal.
- X. Use jumbo size plates for outlets installed in masonry walls.
- Y. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- Z. Install receptacles with weatherproof covers in horizontal position.
- AA. Install receptacles for plug in type show lighting fixtures within 18" of fixture location.
- AB. Install labels identifying source panel and circuit number for all receptacles.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 37 to obtain mounting heights specified.
- B. Install wall switch 48 inches above finished floor.
- C. Install convenience receptacle 18 inches above finished floor.
- D. Install convenience receptacle 6 inches above counter.
- E. Install dimmer 48 inches above finished floor.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Operate each wall switch with circuit energized and verify proper operation.
- E. Verify that each receptacle device is energized.

- F. Test each receptacle to verify operation and proper polarity.
- G. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- H. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 262813 - FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600-V ac and less for use in control circuits and enclosed switches.
 - 2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches and fuseholders.
 - 3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
 - 4. Spare-fuse cabinets.

3.01 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.
- B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.
 - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Coordination charts and tables and related data.

4.01 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

5.01 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

6.01 COORDINATION

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

7.01 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 - PRODUCTS

1.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.01 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

3.01 PLUG FUSES

- A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

4.01 PLUG-FUSE ADAPTERS

- A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

5.01 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

1.01 EXAMINATION

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

2.01 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.
- C. Install spare-fuse cabinet(s).

3.01 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 262818 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fusible switches.
- B. Nonfusible switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Nameplates.
- D. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.

- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- E. Project Record Documents: Record actual locations of enclosed switches.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.
- D. Products: Listed and classified by Underwriters Laboratories Inc. or approved nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens: www.sbt.com.
- E. ESL Power Systems Inc. (800) 922-4188.
- H. Substitutions: Not permitted.

2.02 COMPONENTS

- A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - 2. Handle lockable in OFF position.
 - 3. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.
- B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - 2. Handle lockable in OFF position..
- D. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Nema 3R

3. General Kitchen Area: Recessed type enclosures.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install enclosed switches in accordance with manufacturer's instructions.
- B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 05 29.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 05 26.
- H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Provide identification nameplate for each enclosed switch in accordance with Section 26 05 53.
- K. Provide identification label on inside door of each fused switch indicating NEMA fuse class and size installed in accordance with Section 26 05 53.
- L. Provide arc flash warning labels in accordance with NFPA 70.
- M. Install fuses in fusible disconnect switches.
- O. Install warning label on front of enclosure per NEC 110.16 to warn qualified persons of potential electric arc flash hazards.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 264313 - TRANSIENT VOLTAGE SUPPRESSION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

- A. Section includes field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.
- B. Related Sections:
 - 1. Division 26 Section "Switchboards" for factory-installed TVSS.
 - 2. Division 26 Section "Panelboards" for factory-installed TVSS.
 - 3. Division 26 Section "Wiring Devices" for devices with integral TVSS.

3.01 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

4.01 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.
- B. Qualification Data: For qualified testing agency.
- C. Product Certificates: For TVSS devices, from manufacturer.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For TVSS devices to include in emergency, operation, and maintenance manuals.
- F. Warranties: Sample of special warranties.

5.01 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member Company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
- D. Comply with NEMA LS 1.
- E. Comply with UL 1283 and UL 1449.
- F. Comply with NFPA 70.

6.01 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 1. Notify Construction Manager no fewer than two days in advance of proposed electrical service interruptions.
 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.
- B. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:
 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
 3. Humidity: 0 to 85 percent, noncondensing.
 4. Altitude: Less than 20,000 feet (6090 m) above sea level.

7.01 COORDINATION

- A. Coordinate location of field-mounted TVSS devices to allow adequate clearances for maintenance.
- B. Coordinate TVSS devices with Division 26 Section "Electrical Power Monitoring and Control."

8.01 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

9.01 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. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

1.01 SERVICE ENTRANCE SUPPRESSORS

- 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 product indicated on Drawings or comparable product by one of the following:
 - 1. ABB USA.
 - 2. AC Data Solutions.
 - 3. Advanced Protection Technologies Inc. (APT).
 - 4. Atlantic Scientific.
 - 5. Current Technology Inc.; Danaher Power Solutions.
 - 6. Danaher Power Solutions; United Power Products.
 - 7. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 8. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 9. Intermatic, Inc.
 - 10. LEA International.
 - 11. Leviton Mfg. Company Inc.
 - 12. Liebert Corporation; a division of Emerson Network Power.
 - 13. Northern Technologies, Inc.; a division of Emerson Network Power.
 - 14. Siemens Energy & Automation, Inc.
 - 15. Square D; a brand of Schneider Electric.
 - 16. Surge Suppression Incorporated.
- C. Surge Protection Devices:
 - 1. Non-modular.
 - 2. LED indicator lights for power and protection status.
 - 3. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
- D. Surge Protection Devices:
 - 1. Comply with UL 1449.
 - 2. Modular design (with field-replaceable modules).
 - 3. Fuses, rated at 200-kA interrupting capacity.
 - 4. Fabrication using bolted compression lugs for internal wiring.
 - 5. Integral disconnect switch.
 - 6. Redundant suppression circuits.
 - 7. Redundant replaceable modules.

8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
 9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 10. LED indicator lights for power and protection status.
 11. Audible alarm, with silencing switch, to indicate when protection has failed.
 12. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 13. Four-digit transient-event counter set to totalize transient surges.
- E. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
- F. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2
1. Line to Neutral: 70,000 A.
 2. Line to Ground: 70,000 A.
 3. Neutral to Ground: 50,000 A.
- G. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120 V.
 2. Line to Ground: 400 V for 208Y/120 V.
 3. Neutral to Ground: 400 V for 208Y/120 V.
- H. Protection modes and UL 1449 SVR for 240/120 V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- I. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 400 V, 800 V from high leg.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- J. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:
1. Line to Line: 1000 V for 240 V.
 2. Line to Ground: 1000 V for 240 V.

2.01 PANELBOARD SUPPRESSORS

- 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. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. ABB USA.
2. AC Data Solutions.
3. Advanced Protection Technologies Inc. (APT).
4. Atlantic Scientific.
5. Current Technology Inc.; Danaher Power Solutions.
6. Danaher Power Solutions; United Power Products.
7. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
8. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
9. Intermatic, Inc.
10. LEA International.
11. Leviton Mfg. Company Inc.
12. Liebert Corporation; a division of Emerson Network Power.
13. Northern Technologies, Inc.; a division of Emerson Network Power.
14. Siemens Energy & Automation, Inc.
15. Square D; a brand of Schneider Electric.
16. Surge Suppression Incorporated.

C. Surge Protection Devices:

1. Non-modular.
2. LED indicator lights for power and protection status.
3. Audible alarm, with silencing switch, to indicate when protection has failed.
4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

D. Surge Protection Devices:

1. Comply with UL 1449.
2. Modular design (with field-replaceable modules).
3. Short-circuit current rating complying with UL 1449, and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors.
4. Fuses, rated at 200-kA interrupting capacity.
5. Fabrication using bolted compression lugs for internal wiring.
6. Integral disconnect switch.
7. Redundant suppression circuits.
8. Redundant replaceable modules.
9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
10. LED indicator lights for power and protection status.
11. Audible alarm, with silencing switch, to indicate when protection has failed.
12. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
13. Four-digit transient-event counter set to totalize transient surges.

E. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

F. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:

1. Line to Neutral: 70,000 A.
2. Line to Ground: 70,000 A.
3. Neutral to Ground: 50,000 A.

- G. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:
 - 1. Line to Neutral: 400 V for 208Y/120 V.
 - 2. Line to Ground: 400 V for 208Y/120 V.
 - 3. Neutral to Ground: 400 V for 208Y/120 V.
- H. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
 - 1. Line to Neutral: 400 V.
 - 2. Line to Ground: 400 V.
 - 3. Neutral to Ground: 400 V.
- I. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
 - 1. Line to Neutral: 400 V, 800 V from high leg.
 - 2. Line to Ground: 400 V.
 - 3. Neutral to Ground: 400 V.
- J. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:
 - 1. Line to Line: 1000 V for 240 V.
 - 2. Line to Ground: 800 V for 240 V.

3.01 ENCLOSURES

- A. Indoor Enclosures: NEMA 250 Type 1.
- B. Outdoor Enclosures: NEMA 250 Type 3R.

PART 3 - EXECUTION

1.01 INSTALLATION

- A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 - 1. Provide multiple, 30-A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

2.01 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
 - 2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
 - 3. Complete startup checks according to manufacturer's written instructions.
- E. TVSS device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.01 STARTUP SERVICE

- A. Do not energize or connect service entrance equipment to their sources until TVSS devices are installed and connected.
- B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

4.01 DEMONSTRATION

- A. Train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION

SECTION 265100 – INTERIOR AND EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Exit signs.
- C. Ballasts: fluorescent and HID.
- D. Lamps.
- E. Luminaire accessories.
- H. Exterior luminaires, poles and accessories.

1.02 RELATED REQUIREMENTS

- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 37 - Boxes
- F. Section 26 27 26 - Wiring Devices.

1.03 REFERENCE STANDARDS

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.
- B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.
- D. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.
- E. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- G. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2000.
- H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- I. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000 (ANSI/IES RP8).
- J. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- N. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2009.
- O. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.
- Q. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. Shop Drawings:
 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 70 and NFPA 101.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 77 70 - Closeout Procedures, for additional warranty requirements.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or equivalent nationally recognized testing laboratory (NRTL) as suitable for the purpose specified and indicated.

1.10 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.11 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements, for additional provisions.
- B. Furnish two of each plastic lens type.
- C. Furnish one replacement lamp for each lamp type.
- D. Furnish two of each ballast type.
- E. Furnish four fluorescent luminaire disconnects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fixture schedule lists one or more acceptable manufacturers for each fixture type.
- B. Provide all lighting fixtures of each type from the same manufacturer.
- C. Refer to fixture schedule for acceptable manufacturers.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- E. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.03 LUMINAIRES

- A. Furnish products as indicated in Schedule attached to this section.
- B. Fluorescent Luminaire Disconnect: Each tube type fluorescent fixture shall be provided with a luminaire disconnect rated minimum 3A. at 120V. Temperature rating of 105°C, suitable for #12 through #18 AWG connection with either 2 wire or 3 wire leads.
 - 1. Product - Thomas and Betts "Sta-Kon" or Ideal "PowerPlug".

2.04 BALLASTS

- A. All Ballasts:
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

2.05 LAMPS

- A. Manufacturers:
 - 1. GE Lighting: www.gelighting.com.
 - 2. Philips Lighting Co of NA: www.lighting.philips.com.
 - 3. Osram/Sylvania: www.sylvania.com
- B. All Lamps:
 - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
 - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
- C. Lamp Types: As specified for each luminaire. Fixture and lamp schedule at the end of this section shall be enforced in case of conflict with any specific lamp data noted below.
- D. Incandescent Lamps: Standard life, 130V.
- E. Fluorescent Lamps:
 - 1. Super T8 (1" diameter) energy saving straight tube lamps. Electronic or magnetic ballast and lamp combinations to be matched for starting method.

- a. Four foot lamp with rated life of 30,000 hours, minimum initial lumen output of 3150, minimum CRI of 85, and color temperature of 3000K.
 - b. Shatterproof tubes shall be provided for fluorescent lamps in all open style fluorescent fixtures such as striplights or industrial reflector type fixtures (lamps not behind a protective barrier). Fixtures with wire guards shall also be provided with shatterproof tubes.
- 2. U-Bent super T8 type 32 watt fluorescent lamps shall have 6 inch leg spacing, minimum 20,000 hours rated life, minimum initial lumen output of 2850, minimum CRI of 82, and color temperature of 3000 K.
- 3. Compact fluorescent type T4 with single, double, triple or quad tubes with 4 pin bases. Lamps shall have minimum 10,000 hours rated life, CRI of 82 and a color temperature of 3000 K. Where noted, compact fluorescent lamps for use on dimming and electronic ballasts shall have minimum 12,000 hours rated life, CRI of 82 and a color temperature of 3000 K.
- 4. Compact fluorescent type T5 high lumen output lamps shall have minimum 20,000 hours rated life (18 watt, 1250 lumen or 40 watt, 3150 lumen), CRI of 82 and a color temperature of 3000 K.
- F. High Intensity Discharge (HID) Lamps:
 - 1. Metal halide lamps shall be coated ceramic type, universal operating position, type E17, PAR, or BT as noted for each individual fixture, encapsulated type for either open or closed bottom type fixtures, minimum CRI of 85 and a color temperature of 3000 K.
- G. Reflector Lamps: Beam patterns in accordance with ANSI C78.379. All line voltage halogen PAR lamps and low voltage reflector lamps shall have infrared conserving technology for maximum efficacy. Low voltage lamps shall have hard coated dichroic reflector and 4000 hours rated life. Line voltage halogen lamps shall be rated 130V.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) NECA 500 and 502.
- F. Provide a lighting fixture for each lighting outlet indicated.

- H. Support luminaires independent of ceiling framing. EMT conduit shall not be used to support suspended fixtures of any type. Suspension shall be by means of standard hangers, where available and applicable, by rigid threaded conduit and fittings, or by rods.
- I. Recessed luminaires:
 - 1. Provide recessed and semi recessed fixtures with plaster frames compatible with ceiling and wall systems employed and secure fixtures mechanically to frame.
 - 2. Install recessed luminaires to permit removal from below. Factory paint all trims for recessed ceiling fixtures in guest areas to match Owner provided custom color chip.
 - 3. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
 - 4. Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Fixtures shall fit snugly against ceiling to prevent light leakage.
- J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other at uniform elevations. Secure luminaires to prevent movement as follows:
 - 1. Fixtures not over 12 inches wide and not over 50 inches long: Minimum 2 fastenings.
 - 2. Fixtures not over 12 inches wide and over 50 inches long: Minimum 3 fastenings.
 - 3. Fixtures over 12 inches wide and not over 50 inches long: Minimum 4 fastenings.
 - 4. Fixtures over 12 inches wide and over 50 inches long: Minimum 6 fastenings.
- K. Where fixtures are to be mounted on, or suspended from, concrete ceilings, provide cast in place inserts.
- L. Fixtures shall not be supported by outlet box cover screws alone. Provide a fixture stud or "hickey" for fixtures weighing greater than 25 lbs. for added support.
- M. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.
- N. Install accessories furnished with each luminaire.
- O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture.
- P. Connect luminaires and exit signs to branch circuit outlets provided under Section 26 05 37 as indicated.
- Q. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- R. Bond poles and metal accessories to branch circuit equipment grounding conductor.
- S. Install specified lamps in each emergency lighting unit, exit sign, and luminaire. Install each lighting fixture with lamps indicated on lamp schedule.
- T. Replace any excessively noisy ballasts.
- U. Provide concrete bases for lighting poles or bollard type fixtures at locations indicated.
- V. Owner furnished fixtures:
 - 1. Install a designated fixture at each outlet indicated.
 - 2. Provide and install lamps for each fixture as noted in the show lighting lamp schedule.
 - 3. Provide necessary supports and hangers.
- W. Provide necessary hardware and connectors to make specified track lighting a complete operational system. System components shall be fabricated by the same manufacturer (i.e. fixtures, track, connectors, hanging hardware, etc.) to ensure compatibility.
- Y. Install lamps in each luminaire.
- Z. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

- B. Inspect each product for damage and defects.
- C. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.
- D. Operate each luminaire after installation and connection to verify proper operation.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.
- F. Test each support for fixtures with a weight of not less than 50 lbs. or three times the weight of installed fixture, whichever is greater.
- G. Measure illumination levels to verify conformance with performance requirements. Take exterior lighting measurements during night sky, without moon or with overcast clouds effectively obscuring the moon.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.
- C. Aim and adjust fixtures as directed.
- E. Egress lighting shall have an adjustment period occurring after installation and verification of said equipment to achieve the average required emergency lighting level of 1 fc along the egress pathway. Provide appropriate personnel (electricians, carpenters, laborers, etc.) as necessary to support this adjustment period. Adjustment is defined as orientation or aiming of adjustable fixtures or clearing of light pathway from fixture location to the egress pathway.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.
- F. Clean and relamp existing fixtures to be reused.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 77 70 - Closeout Procedures, for closeout submittals.
- B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- C. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

3.09 PROTECTION

- A. Relamp burned out luminaires at Substantial Completion with new lamps of same type, manufacturer and wattage. This fixture relamping effort shall include reorientation of any fixture or fixture accessory that has been moved from its aim or focus and repairing or replacing any fixture accessory that has been damaged, removed, or misaligned as a result of fixture relamping.

END OF SECTION

SECTION 283100 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Maintenance of fire alarm system under contract for specified warranty period.
- C. Fire alarm system control panel.
- D. Analog smoke and heat sensors.
- E. Fire alarm notification appliances.
- F. Addressable circuit interface modules.
- G. Peripheral fire alarm equipment.
- H. Accessory relays to interface with ride systems, show control systems, audio control circuits, exit sign, egress lighting, HVAC, and smoke management systems.
- I. Programming modifications to the existing networked fire alarm reporting system.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low Voltage Electric Power Conductors and Cables.
- D. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- F. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.
- G. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).
- B. IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage Power Circuits; 1991 (R1995).
- C. NFPA 70 - National Electrical Code; 2008.
- D. U.L. 268 - Smoke Detectors for Fire Protective Signalling Systems.
- E. U.L. 864 - Standard for Control Units and Accessories for Fire Alarm Systems.
- F. U.L. 1480 - Standard for Speakers for Fire Protective Signalling Systems.
- G. U.L. 1971 - Standard for Safety Signalling Devices for the Hearing Impaired.
- H. NFPA 72 - National Fire Alarm Code and Signaling Code ; 2010.
- I. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2009.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Proposal Documents: Submit the following with cost/time proposal:
 - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 2. Manufacturer's detailed data sheets for each control unit, initiating devices, and notification appliances including the following:
 - a. Control Panel.

- b. Analog addressable multi-criteria smoke and heat sensors.
 - c. Smoke and heat sensor bases.
 - d. Stand by emergency/secondary power supply.
 - e. Signalling appliances (horns, speakers, strobes, bells).
 - f. Manual alarm stations.
 - g. Manual alarm station breakglass safety covers.
 - h. Surge suppressors for power supply, initiating, signal line and notification circuits.
 - i. Addressable loop network cable and DC power cable.
 - j. Contact monitoring devices.
 - k. Releasing devices.
 - l. Addressable relays.
 - m. Addressable circuit interface modules.
- D. Evidence of designer qualifications.
- E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
- 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Figure A.10.6.2.3(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 11. Detailed aspirating smoke detection system calculations, drawings and diagrams:
 - a. System summary information including tabulated information on each system pipe length, number of sampling holes, hole spacing, hole % balance and % share, and transport times.
 - b. Pipe network layouts including isometric and wiring diagrams. Calculations shall be provided from a registered air sampling pipe modeling program (ASPIRE2 version 1.21.01 or later).
 - c. System design calculations, installation standards and Commissioning forms.
 - 14. Certification by Contractor that the system design complies with the contract documents.
- F. Evidence of installer qualifications.
- 2. Copy of current active State of Florida Alarm Contractor 1 EF License and National Institute for Certification in Engineering Technologies (NICET) certifications, minimum Level II for all installation technicians. All personnel shall be fire alarm system agent (FASA) certified as required by F.S. 489.5185 and F.S. 633.702(4). All personnel shall have in their possession a current valid FASA card and produce it for inspection upon request by owners representative.
- G. Evidence of instructor qualifications; training lesson plan outline.
- H. Evidence of maintenance contractor qualifications, if different from installer.
- I. Inspection and Test Reports:
- 1. Submit inspection and test plan prior to closeout demonstration.
 - 2. Submit documentation of satisfactory inspections and tests.

- J. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
 - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
 - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 - 4. List of recommended spare parts, tools, and instruments for testing.
 - 5. Replacement parts list with current prices, and source of supply.
 - 6. Detailed troubleshooting guide and large scale input/output matrix.
 - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 - 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- K. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
 - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 - 3. "As programmed" operating sequences, including control events by device, updated input/output matrix, and voice messages by event.
 - 4. Provide laminated color scaled floor plans of the facility showing the location of all initiating devices and / or zones, including the coverage of all aspirating smoke detectors.
 - 5. Submit three copies of final project record documents.
- L. Closeout Documents:
 - 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 - 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
 - 3. Certificate of Occupancy.
- M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
 - 1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and deliver to owner's representative or Reedy Creek Fire Services.
 - 2. Submit three copies of closeout documents.

1.05 QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
- B. Manufacturer's Qualifications: Company specialized in manufacturing the products specified in this section for minimum 10 years.
 - 1. Name of manufacturer, part number, and serial number shall appear on all major components.
 - 2. Products: Furnish products listed and classified by Underwriter's Laboratories Inc. or approved nationally recognized testing laboratories (NRTL) as suitable for the purpose specified and indicated.
 - 3. All major system components shall be new and standard products of a single manufacturer. Certain individual components, as noted in this specification, may be supplied by other manufacturers.

- C. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- D. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 - 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 - 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 - 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
 - 4. Certified in the State in which the Project is located as fire alarm installer.
 - 5. Show evidence of a minimum two million dollar liability and completed operations insurance policy. These limits supercede limits required elsewhere in this specification.
 - 6. Proof of emergency service availability 24 hours a day, seven days a week.
- E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- F. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.06 EXTRA MATERIALS AND TOOLS

- A. See Section 01 60 00 - Product Requirements, for additional provisions.
- B. In addition to the items in quantities indicated in PART 2, provide the following:
 - 1. CD-ROM copies, 2, of all software not resident in read-only-memory.
 - 2. Fuses, 2 for each installed fuse; store inside applicable control cabinet.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Fire Alarm Control Units - Basis of Design:
 - a. Siemens Building Technologies, Inc.
 - b. Silent Knight
 - c. Edwards/Notifier
- B. Initiating Devices, and Notification Appliances:
 - 1. Siemens Building Technologies, Inc:
 - 2. Silent Knight
 - 3. Edwards/Notifier
- C. Miscellaneous items: Manufacturers as noted below for each individual product.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic micro processor based fully addressable fire detection and alarm system capable of communicating and controlling addressable analog devices and sensors.
 - 1. Provide all components necessary, regardless of whether shown in the contract documents or not.
 - 2. Protected Premises: Entire building shown on drawings.
 - 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. The Americans With Disabilities Act (ADA).
 - c. The requirements of the local authority having jurisdiction.
 - d. Applicable local codes.
 - e. The contract documents (drawings and specifications).
 - f. NFPA 101.
 - g. NFPA 72; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 - h. System shall meet NFPA 72 requirements as a calibrated smoke sensitivity fixture.
 - 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 - 5. Control Functions: All control functions shall be activated within three seconds after receipt of alarm condition for a fully loaded system. Response times measured from activation of initiating device to activation of associated notification appliance circuit.
 - 6. Malfunctions and False Alarms: Shall not occur from any automatic sensor due to electrical noise such as high frequency pulses or electromagnetic influences emitted from other electronic equipment.
 - 10. Hearing Impaired Occupants: Provide visible notification devices in all public areas.
 - 11. Combined Systems: Do not combine fire alarm system with other non-fire systems.
 - 12. Programming and system configuration:
 - d. Provide a Learn or Compare Mode to identify changes in the installed system with the system configuration. Identified changes will then be presented to the user for validation. The Learn or Compare Mode shall also provide a means to program groups of devices with the same operating characteristics to minimize configuration times and errors.
 - e. Capable of sensitivity settings of each sensor based on time of day and day of week.
 - f. A copy of all software documentation shall be maintained on the construction site in a binder, arranged in chronological order. This binder shall be turned over to Owner after all start up, testing, commissioning, programming and demonstrations are completed.
 - g. Once the fire alarm system is put into service, in whole or in part, no software changes shall be performed without written consent of Owner. If software changes are needed, they shall be performed by certified manufacturer's technicians.
 - 14. Local network:
 - a. An addressable network shall provide communications with all initiating and control devices individually. Control panel annunciation for each device shall include alarm, trouble, open, short, ground, device fail or incorrect device.
 - b. All addressable devices shall have the capability of being disabled or enabled individually.
 - c. Each device shall be identified by a unique address code.
 - d. Communication format shall be a fully digital poll/response type protocol. Communications reliability shall be obtained by using parity data bit error checking routines for address codes and sum routines for data transmission protocol.

2.04 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervisory Alarm: Provide supervisory signals in accordance with NFPA 72 for the following:
 - 1. Sprinkler water control valves.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
 - 1. Sprinkler water flow.
 - 3. Duct smoke detectors: Close dampers indicated; shut down air handlers indicated.
- D. System Control Outputs:
 - 1. HVAC:
 - a. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.05 COMPONENTS

- A. General:
 - b. System activation shall be initiated by one smoke sensor (with alarm verification) or at aspirating smoke detection Pre-Alarm Level 2. Subsequent device activation of same device or devices in adjacent zones will not change system operation.
 - c. System activation shall be initiated by one smoke sensor (with alarm verification) or at aspirating smoke detection Action Level 2. Subsequent device activation of same device or devices in adjacent zones will not change system operation.
 - d. All normal HVAC air handling systems serving the building shall shut down upon initiation of a smoke sensor anywhere in that zone.
 - e. Initiation of smoke detection system or smoke sensor in a smoke zone shall simultaneously activate all indicated make up air damper openings.
- E. Initiating Devices:
 - 1. Manual Pull Stations:
 - a. Addressable single action, mechanically latching, manual resetting type.
 - b. Durable high impact construction, red with white lettering.
 - c. Front of station shall be hinged to a backplate assembly and must be opened with a key to reset. Key shall be common with the FACP. Allen wrenches or special tools to reset are not acceptable.
 - d. Products:
 - 2) Siemens Building Technologies, Inc. HMS-S.
 - 3) Outdoor pull station: Siemens Building Technologies, Inc. MSM-K-WP with HTRI-S addressable contact module located in conditioned space.
 - e. Each pull station shall be provided with a breakglass safety cover with spacer and mounting hardware.
 - 1) For interior dry locations:
 - (b) Product: Safety Technology International STI-4130.
 - 2) For exterior damp or wet locations:
 - (b) Product: Safety Technology International STI-4130 with STI-3002 weather gasket.
 - f. Provide 1 extra each of a manual pull station and 3 extra breakglass safety covers.
 - 2. Smoke Sensors (Detectors):
 - a. Analog Multi Criteria (Heat or Smoke) Sensors:
 - 1) Each sensor shall store the sensor address and operating characteristics in non volatile memory at the sensor. Sensor shall use a threshold received from the control unit to determine when an alarm condition exists.
 - 2) Each sensor shall have alarm LED's for viewing. The alarm LED's shall flash when communicating with the control panel and shall change state during alarm conditions.
 - 3) Each sensor shall be capable of compensating for dust and dirt accumulation within the sensor chamber.
 - 4) Sensor shall combine photoelectric smoke sensing and heat sensing principles within one housing.

- 6) Products:
 - (a) Sensor head: Siemens Building Technologies, Inc. HFP-11. Sensor head factory or field painted black per manufacturer's requirements as noted on drawings.
 - (b) Addressable sensor base: Siemens Building Technologies, Inc. DB-11. Sensor bases factory or field painted black per manufacturer's requirements
 - (c) Addressable sensor base with relay: Siemens Building Technologies, Inc. DB-HR. Sensor bases factory or field painted black per manufacturer's
- 7) Provide 3 extra each of sensor and sensor base.
- b. Air Duct Smoke Sensors (Detectors) and Accessories:
 - 1) Analog photo sensors shall be utilized at all air duct monitoring locations.
 - 2) Sampling tubes to suit specific duct sizes. Continuous cross sectional sampling of air with supply and return air tubes which average the effects of laminar flow, stratification or skin effect phenomena.
 - 3) Sampling tubes shall be listed by the manufacturer for the specific detector used.
 - 6) Air duct sensor housing mounted directly to ducting system. Ducting system supplied with access panels for sampling tube maintenance. Duct sensor locations shall be coordinated and confirmed by Walt Disney World Company, Facility Systems Department.
 - 7) Relay output provision to operate supplementary equipment as noted.
 - 9) Products:
 - (a) Sensor head: Siemens Building Technologies, Inc. HFP-11.
 - (b) Addressable sensor base: Siemens Building Technologies, Inc. DB-11.
 - (c) Air duct sensor housing: Siemens Building Technologies, Inc. AD-11P.
 - (d) Air duct sensor housing with relay: Siemens Building Technologies, Inc. AD-HR.
 - (e) Weatherproof air duct sensor housing: Siemens Building Technologies, Inc. WP-2000.
 - (f) Sampling tubes: Siemens Building Technologies, Inc. STA series.
 - (g) Remote alarm indicator: Siemens Building Technologies, Inc. RLW-11.
 - 10) Provide 1 extra each of sensor, sensor base and housing.
3. Analog Thermal Sensors (Heat Detectors):
 - a. Each sensor shall store the sensor address and operating characteristics in non volatile memory at the sensor. Sensor shall use a threshold received from the control unit to determine when an alarm condition exists.
 - b. Each sensor shall have alarm LED's for viewing. The alarm LED's shall flash when communicating with the control panel and shall change state during alarm conditions.
 - d. The set point for the thermal sensor shall be 135° F (38° to 57.2° C). The thermal detector shall be capable of operating on either a fixed temperature principle or rate of rise principle.
 - f. Products:
 - 1) Sensor head: Siemens Building Technologies, Inc. HFPT-11.
 - 2) Addressable sensor base: Siemens Building Technologies, Inc. DB-11.
 - g. Provide 3 extra each of sensor and sensor base.
4. Addressable Circuit Interface Modules:
 - a. Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of water flow, valve tamper, non-addressable devices, and for control of air handling equipment. Modules shall be mounted in a standard 4" square electrical outlet box and will include cover plates to allow for surface or flush mounting. Modules shall receive their operating power from the signaling line circuit. The following types of modules shall be used:
 - b. Monitor Circuit Interface Output Module (Type 1):
 - 1) Each supervised output module shall be rated to operate listed notification appliances.

- 2) Circuit shall be rated for 2.0 amps at 24VDC.
- 3) Each module shall store the sensor address and operating characteristics in non volatile memory at the module.
- 4) Each module shall be individually selectable for silencing and walktest. A module programmed to operate during walktest will initiate the programmed pattern for 4 seconds when the appropriate initiating conditions are satisfied.
- 5) Each module shall operate under up to 16 different conditions occurring in the system. These conditions include combining various zones and zone states.
- 7) Products:
 - (a) Siemens Building Technologies, Inc. HCP.
- c. Monitor Circuit Interface Input Modules (Type 2):
 - 1) Contact modules shall provide monitoring of dry contacts as initiating devices.
 - 2) Each module shall store the sensor address and operating characteristics in non volatile memory at the module.
 - 3) Mount module to a standard junction box and provide visual indication of status via status LED's. Optional mounting shall be available to allow mounting the
 - 5) Products:
 - (a) Siemens Building Technologies, Inc. HTRI-S (single input) or HTRI-D (dual input) or HTRI-M (single input).
- d. Single Address Multi Point Input Modules (Type 3):
 - 1) Dual Input with Single Relay Output:
 - (a) Input to provide monitoring of two supervised dry contact initiating circuits and supply a single relay output from a single address.
 - (b) Simplex relay (IAM) 4090-9118 (CSFM # 7300-0026:311) with 4090-9802 trim plate for LED viewing in a surface mounted box.
 - 2) Single Input with Single Relay Output:
 - (a) Input to provide monitoring of an supervised dry contact initiating circuits and supply a single relay output from a single address.
 - (b) Simplex relay (IAM) 4090-9119 (CSFM # 7300-0026:311) with 4090-9802 trim plate for LED viewing in a surface mounted box.
 - 3) Four Inputs with Dual Relay Outputs:
 - (a) Inputs to provide monitoring of four supervised dry contact initiating circuits and supply two relay outputs from a single address.
 - (b) Simplex relay (IAM) 4090-9120 (CSFM # 7300-0026:311) with 4090-9802 trim plate for LED viewing in a surface mounted box.
- e. Line Powered Control Circuit Relay Module (Type 4):
 - 1) Module shall provide control and status tracking of a Form "C" contact.
 - 2) Module shall provide independently operating and configurable relay.
 - 3) Relay shall be rated for 2.0 amps at 24 VDC.
 - 4) Each module shall store the sensor address and operating characteristics in non volatile memory at the module.
 - 5) Each module shall operate under up to 16 different conditions occurring in the system. These conditions include combining various zones and zone states.
 - 6) Module shall operate relay without requiring a separate power source.
 - 8) Product: Siemens Building Technologies, Inc. HTRI-R.
- F. Notification Appliances:
 1. Bells:
 - a. 10 inch diameter 120VAC polarized red vibrating outdoor type with minimum audible signal output level of 88 dBa at 10 feet.
 - b. Product:
 - 1) Wheelock 43T-G10-115-R.
 - 2) Gentex GB10-120.
 - 3) Siemens Building Technologies, Inc. BT-AC.
 2. Horns:

- a. Low current 24VDC multi tone electronic type, red housing with white lettering.
 - b. Sound output of 80 - 85 dBA at 10 feet.
 - d. Product: Siemens Building Technologies, Inc. U-MMT-1G-W.
- 3. Speaker/Strobes:
 - a. Visual addressable strobe unit meeting NFPA/ANSI standards and ADA Accessibility Guidelines.
 - b. Strobe selectable settings of 15, 75, or 110 candela for ADA compliance, 24VDC with minimum flash rate of 1 flash per second over regulated voltage range.
 - c. Speaker with selectable input of either 25 or 70V RMS, selectable power taps from 1/4 watt to 2 watts, frequency response of 400 to 4000 Hz, and sound output of up to 98 dBA at 10 feet.
 - d. Wall mount or ceiling mount with white faceplate.
 - f. Product: Gentex HS24-15/75WW (ADA compliant).
 - g. Where higher strobe settings are required, a selectable strobe setting unit with settings of 15, 30, 75, 110 candela shall be used.
 - 1) Product: Wheelock NS-24MCW-FW (selectable strobe outputs).
 - h. Weatherproof unit: Gentex WGES-75WW.
- 4. Strobes:
 - a. Non addressable meeting requirements of NFPA/ANSI standards and ADA Accessibility Guidelines.
 - b. Strobe settings of 15/75 candela for ADA compliance, 24VDC with minimum flash rate of 1 flash per second over regulated voltage range.
 - d. Product: Siemens Building Technologies, Inc. U-MCS-W (white body).
- 5. Synchronization Control Modules:
 - a. Dual output type for control of either Class A or Class B notification appliance circuits.
 - b. Ability to silence horn or speaker but maintain strobe flash.

2.06 CONDUIT AND CABLE

- A. Conduit
 - 1. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40% of the interior cross sectional area where three or more cables are included within a single conduit.
 - 2. Separate cables from any open conductors of Class 1 circuits and do not place in any conduit, junction box, or raceway containing Class 1 cables.
 - 3. Wiring for low voltage control, alarm notification, emergency communications, and similar power limited auxiliary functions may be installed in the same conduit as initiating an signaling line circuits.
 - 4. Conduits shall not enter the control panel or any other component provided except where entry is specified by the manufacturer.
 - 5. Conduit shall be minimum 3/4 inch (20 mm).
- B. Cable
 - 1. Conductor size shall not be less than 18 AWG for initiating devices or signaling line circuits and 14 AWG for notification appliance circuits.
 - 2. All wiring shall be supervised for open circuits, short circuits, and grounded conditions.
 - 3. Cross sectional area of wiring shall be selected to limit voltage drop to less than 10% of nominal voltage for devices which require higher currents (alarm horns, bells, and sirens).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.
 - 1. No smoke sensors shall be located with 60 inches of any supply or return air ducts.

- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.
- E. Aspirating smoke detection:
 - 1. Air sampling pipe shall be supported at not less than 5 foot centers.
 - 2. All joints in air sampling pipe shall be air tight and made by using solvent cement, except at entry to the detector. Glue shall be applied to pipe ends only and pressed into dry fittings and rotated, to avoid build up of glue inside the pipe connection.
 - 3. The far end of each sampling pipe shall be fitted with an end cap and drilled with a hole appropriately sized to achieve the performance as calculated by the system design. This end cap shall be located at no more than 60" above finished floor for ease of maintenance access and system testing.
 - 4. Sampling hole size shall be calculated based on transport time of smoke sampled from the farthest sampling point to reach the detector with an allowable transport time of less than 120 seconds. U.L. listed for use in plenum spaces.
 - 5. Each sample hole shall be chamfered on the exterior edge by countersinking the hole with a larger drill bit size to reduce debris build up around the sample hole.
 - 6. Each sampling pipe shall have a socket union installed 12" above the Hoffman enclosure to allow for disconnection and cleaning of the sampling pipe.
 - 7. Each sampling pipe shall have an inline filter installed as a prefilter before the socket union.
 - 8. Each back of house (BOH) sampling point shall be identified utilizing Vesda E700-SP-DCL labels. No other labeling method shall be accepted.
- F. Painting of devices:
 - 1. Horn/Strobe assembly bodies:
 - a. Field painting of specific devices shall be required as noted on drawings.
 - b. When painting the device body, the body should be removed and painted to avoid damage and/or coating of speaker.
 - c. If the word "FIRE" is located on the strobe, then the entire device body can be painted.
 - d. If the word "FIRE" is located on the sides of the device, the face with the word "FIRE" cannot be painted but remaining body can be painted.
- A. Notify Owner 14 days prior to beginning completion inspections and tests.
- B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- F. Provide all tools, software, and supplies required to accomplish inspection and testing.
- H. System start up and commissioning shall include trial operation of all main and peripheral equipment and software programming of local FACP.
- I. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- J. Proper air duct sensor air flow shall be demonstrated using manufacturer's approved test equipment. Documentation of air flow velocity shall be provided and shall include velocity, air handler name, sensor location, manufacturer and model number of testing device. This testing shall be conducted after the air handling system's testing and balancing work has been completed.
- K. One Man Walk Test with History Logging

1. System shall be capable of being tested by one person. While in test mode, the alarm activation of an initiating device circuit shall be silently logged in the history data log. FACP shall automatically reset after logging of the alarm.
2. Momentary disconnection of an initiating or indicating device circuit shall be logged as a trouble condition in the history data log. FACP shall automatically reset after logging of the trouble condition.
3. Optionally, the walk test sequence will have the capability of activating the alarm indicating appliances for a maximum of 2 seconds. If this option is selected, any momentary opening of an initiating or indicating appliance circuit's wiring shall cause the alarm indicating appliances to sound for 4 seconds to indicate a trouble condition.
4. Walk test feature shall revert to normal mode automatically if the feature is activated for an inappropriate amount of time. Set time as directed by local authority having jurisdiction.
5. The FACP shall be capable of supporting up to eight separate testing groups whereby one group of points may be in a testing mode and other (nontesting) groups may be active and operate as programmed per normal system operation. After testing is complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
6. Should an alarm condition occur from an active point not in walk test mode, it shall perform all standard programmed alarm sequences.
7. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
8. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 - a. Record all system operations and malfunctions.
 - b. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - c. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
 - d. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 1. Hands-On Instruction: On-site, using operational system.
- B. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 1. Initial Training: 1 session pre-closeout.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 1. Be prepared to conduct any of the required tests.
 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 4. Proper strobe candela settings shall be adjusted and confirmed with authority having jurisdiction during system commissioning.
 5. Repeat demonstration until successful.
- B. Occupancy of the project will not occur prior to Substantial Completion.
- C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
 1. Specified diagnostic period without malfunction has been completed.

2. Approved operating and maintenance data has been delivered.
3. Spare parts, extra materials, and tools have been delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
6. Occupancy permit has been granted.
7. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

- A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Provide trouble call-back service upon notification by Owner:
 1. Provide on-site response within 2 hours of notification.
 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 313116 - TERMITE CONTROL

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. Soil treatment with termiticide.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.
- B. Qualification Data: For qualified Installer.
- C. Product Certificates: For termite control products, from manufacturer.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- E. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located, and who employs workers trained and approved by manufacturer to install manufacturer's products.

- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label and to comply with EPA regulations and authorities having jurisdiction.
- C. Source Limitations: Obtain termite control products from single source from single manufacturer.
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Apply wood treatment after framing, sheathing, and exterior weather protection is completed but before electrical and mechanical systems are installed.
- D. Do not apply treatments at existing facilities, if any, during occupied hours.

1.6 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

- 1. Warranty Period: 5 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite

infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Subject to compliance with requirements, provide products by manufacturers that may be incorporated into the Work acceptable to the Owner.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than 5 years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the

following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 3. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
 4. Masonry: Treat voids.
 5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

■ Exhibit “A” FIRE-RATED ASSEMBLIES AND PENETRATIONS

GENERAL NOTES:

1. FIRE-RATED ASSEMBLIES AND PENETRATION FIRESTOP SYSTEMS

- A. The following UL and other Fire-Rated Assemblies are referenced on the Drawings as the “Basis-of-Design” for fire safety, sound transmission, material selection, and construction methods.
- B. The date on the Fire-Rated Assemblies is current as of the date it was included in this Project Manual Specifications. The dates are subject to change as the tested assemblies are updated. See the UL Online Certification Directory at <http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html> to search for the latest date for the assembly.
- C. The Contractor may submit alternate assemblies for review and approval by the Architect, prior to construction, to be used in place of the assemblies indicated herein and referenced on the Drawings. The Contractor is also responsible for submitting documentation of the proposed alternate assembly to the Authority Having Jurisdiction (AHJ) for approval prior to construction.
- D. The Contractor shall submit penetration firestop systems for review and approval by the Architect, prior to construction, to be installed and applicable with the materials penetrating the fire-rated assembly. The Contractor is also responsible for submitting documentation of the proposed penetration firestop system to the AHJ for approval prior to construction.
- E. The Contractor shall provide all materials and equipment as indicated in the assembly or system as well as within the system that is part of the assembly. No substitution of materials or additional materials will be accepted and which are not allowed per the assembly or system.
- F. Approval of the assembly or system by the Architect does not release the Contractor from the responsibility of meeting all applicable building codes and regulations.
- G. Inspection of the installed firestop systems shall be performed by a third party inspector in accordance with the NFPA-1-2012 Fire Code Section 12.3.2 Quality Assurance for Penetrations and Joints. See Specification Section 078413 Penetration Firestopping, Field Quality Control requirements.

2. REPRINT PERMISSION

- A. Copies of the following referenced UL designs have been reprinted from the Online Certifications Directory with permission from UL, © 2018 UL LLC.

1 Hour	Design #	GA File #	STC - N/A	IIC - N/A
	FM FC-172	FC 5406	Sound Test # N/A	Test # N/A
 Link to .PDF file Link to .DWG file Link to .DWG/Text file Base Layer 5/8" (15.9 mm) Fire-Shield Gypsum Board applied at right angles to 2x10 wood joists 24" o.c. with 1-1/4" Type W or S drywall screws 24" oc. Face layer 5/8" Fire-Shield Gypsum Board applied at right angles to joists with 1-7/8" Type W or S drywall Screws 12" o.c. at joints and intermediate joists and 1-1/2" Type G screw 12" o.c placed 2" back on either side of end joints. Joints offset 24" from base layer joints. Wood joists supporting 1/2" wood structural panels applied at right angle to joists with 8d nails. Ceiling provides one hour fire resistance protection for framing, including trusses.				



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Design No. L528
BXUV.L528
Fire-resistance Ratings - ANSI/UL 263

[Page Bottom](#)

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

[See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States Design Criteria and Allowable Variances](#)

[See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada Design Criteria and Allowable Variances](#)

Design No. L528

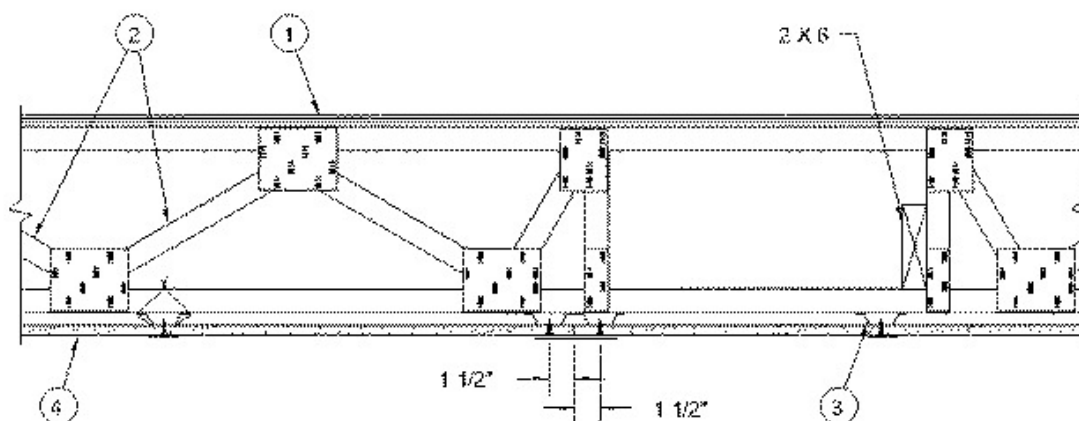
June 22, 2018

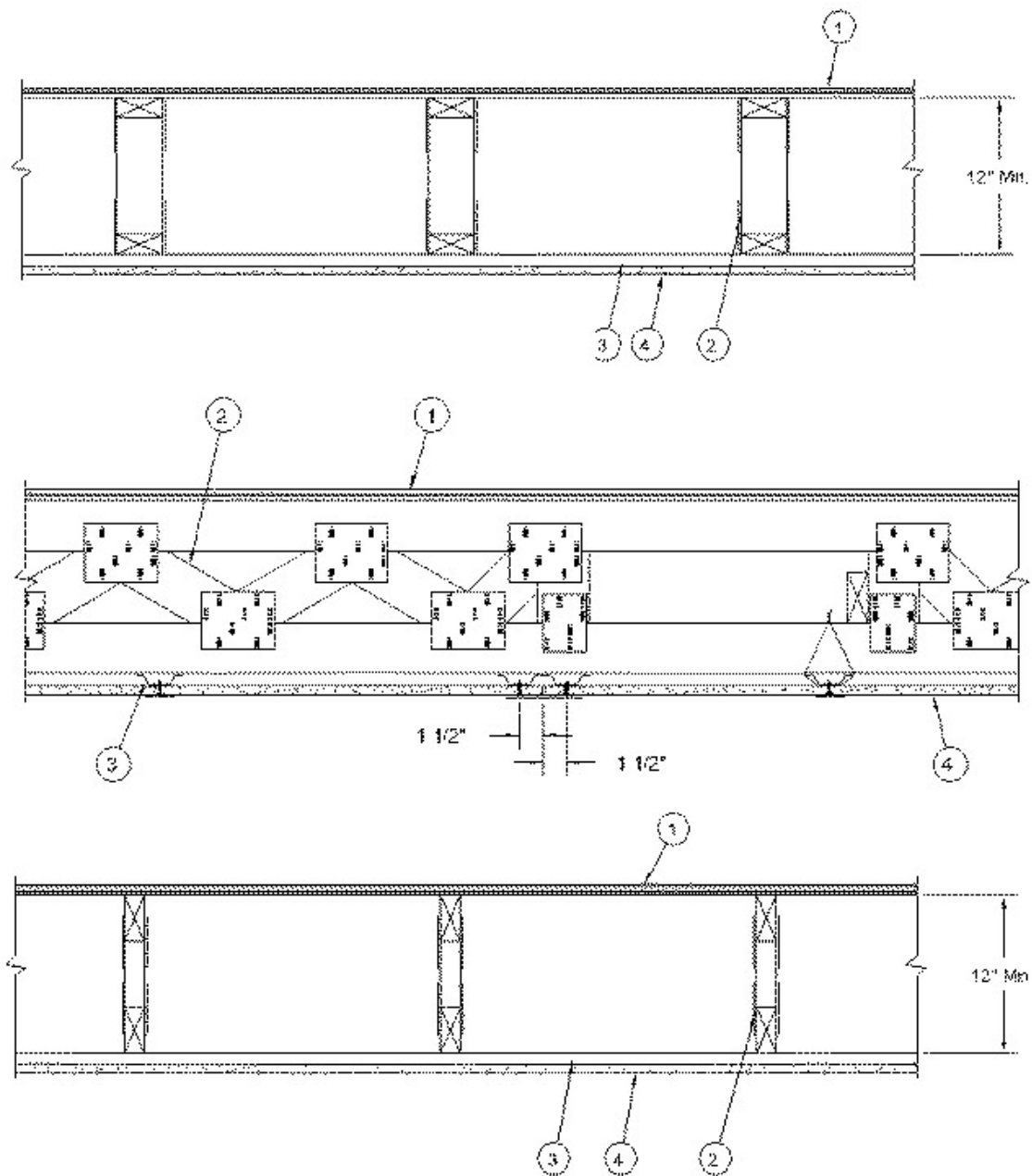
Unrestrained Assembly Rating - 1 Hr.

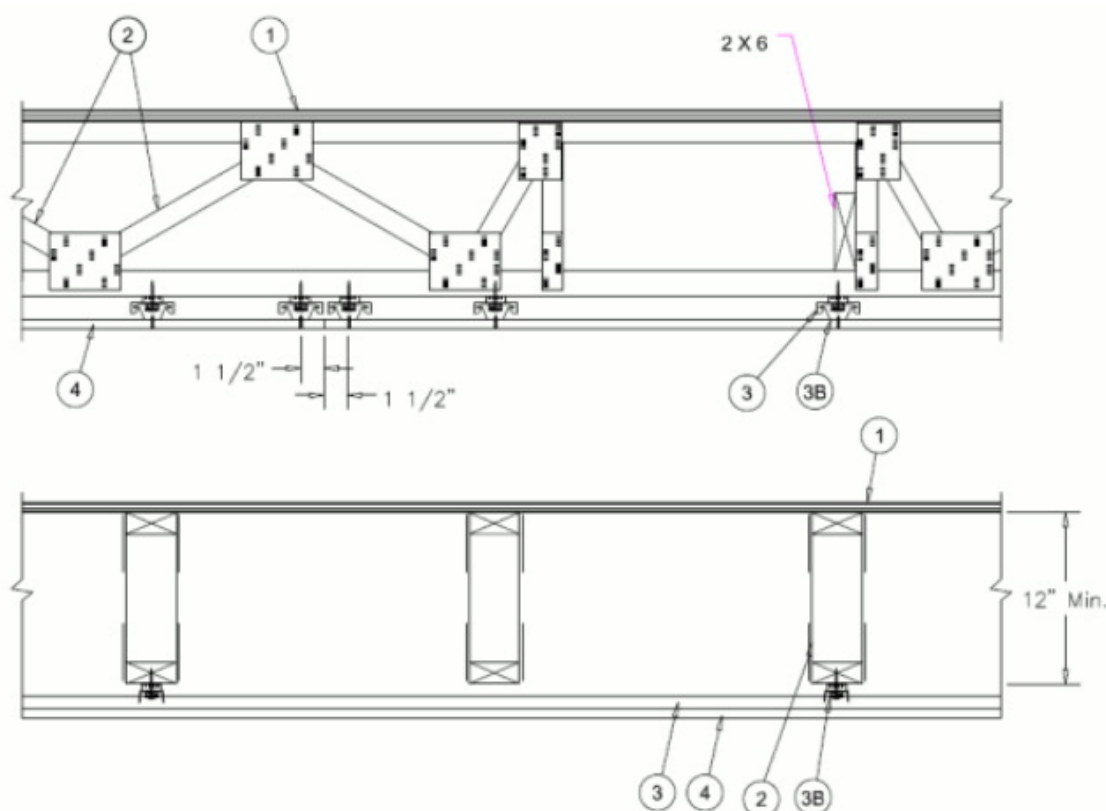
Finish Rating - 22 Min.

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide **BXUV or **BXUV7****

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**







1. **Flooring System** — The flooring system shall consist of one of the following:

System No. 1

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

System No. 2

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) — Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring — Min 3/4 in. thickness of lightweight insulating concrete with **Perlite Aggregate*** or **Vermiculite Aggregate***, or gypsum concrete.

See **Perlite Aggregate** (CFFX) and **Vermiculite Aggregate** (CJZZ) categories for names of manufacturers.

System No. 3

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Floor Mat Materials* — (Optional)— Floor mat material nom 5/64 in. (2 mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1 in. of floor-topping mixture.

ECORE INTERNATIONAL INC — Type QTscu 4002

HACKER INDUSTRIES INC — Type Hacker Sound-Mat.

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/4 in. (6 mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1-1/4 in. (32 mm) of floor-topping mixture.

ECORE INTERNATIONAL INC — Type QTrbm 3006-3

HACKER INDUSTRIES INC — Type Hacker Sound-Mat II.

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/8 in. (3 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 3/4 in. (19 mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 125

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/4 in. (6 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1 in. (25 mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 250, Quiet Qurl 55/025

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 3/8 in. (10 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/4 in. (32 mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 400, Quiet Qurl 60/040

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 3/4 in. (19 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/2 in. (38 mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 750, Quiet Qurl 65/075

Metal Lath — (Optional) — For use with 3/8 in. (10 mm) floor mat materials, 3/8 in. expanded steel diamond mesh, 3.4 lbs/sq yd placed over the floor mat material. Hacker Floor Primer to be applied prior to the placement of the metal lath. When metal lath is used, floor topping thickness a nom 1-1/4 in. over the floor mat.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1100 psi. Mixture shall consist of 6.8 gal of water to 80 lbs of floor topping mixture to 1.9 cu ft of sand.

HACKER INDUSTRIES INC — Firm-Fill Gypsum Concrete, Firm-Fill 2010, Firm-Fill 3310, Firm-Fill 4010, Firm-Fill High Strength, Gyp-Span Radiant

System No. 4

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.010 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a minimum compressive strength of 1800 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

UNITED STATES GYPSUM CO — Types LRK, HSLRK, CSD

LATICRETE SUPERCAP L L C — Types LRK, HSLRK

USG MEXICO S A DE C V — Types LRK, HSLRK, CSD

Floor Mat Materials* — (Optional) — Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

UNITED STATES GYPSUM CO — Types SAM, LEVELROCK® Brand Sound Reduction Board, LEVELROCK® Brand Floor Underlayment SRM-25

Alternate Floor Mat Materials* — (Optional) — Nom 3/8 in. thick floor mat material loose laid over the subfloor. Floor topping thickness shall be as specified under **Floor Topping Mixture**.

GRASSWORX L L C — Type SC50

Alternate Floor Mat Material* — (Optional) - Floor mat material nominal 3/8 in. thick loose laid over the subfloor. Floor topping shall be a min 3/4 in. thick.

System No. 5

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 1-1/2 in. thickness of floor topping mixture having a min compressive strength of 1000 psi and a cast density of 100 plus or minus 5 pcf. Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mixture shall consist of 1.4 cu feet of preformed foam concentrate to 94 lbs Type I Portland cement, 300 lbs of sand with 5-1/2 gal of water.

ELASTIZELL CORP OF AMERICA — Type FF

System No. 6

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 1-1/2 in. thickness of floor topping mixture having a min compressive strength of 1000 psi and a cast density of 100 plus or minus 5 pcf. Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mixture shall consist of 1.2 cu feet of preformed foam concentrate to 94 lbs Type I Portland cement, 300 lbs of sand with 5-1/2 gal of water.

AERIX INDUSTRIES — Floor Topping Mixture

System No. 7

Deleted.

System No. 8

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a minimum compressive strength of 1500 psi. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

MAXXON CORP — Types D-C, GC, GC2000, L-R, T-F, CT, SS

RAPID FLOOR SYSTEMS — Types RF, RFP, RFU, Orcrete

Floor Mat Materials* — (Optional) - Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

MAXXON CORP — Type Acousti-Mat I, Acousti-Mat II, Acousti-Mat II HP, Enkasonic 9110, Enkasonic 9110 HP, Acousti-Mat 3, Acousti-Mat 3 HP, Acousti-Mat LP, Acousti-Mat LP-R, Acousti-Mat SD.

Floor Mat Reinforcement — (Optional) - Refer to manufacturer's instructions regarding minimum thickness of floor topping over each floor mat material, primers, and use of crack suppression reinforcement.

MAXXON CORP — Crack Suppression Mat (CSM) or Maxxon Reinforcement (MR)

Metal Lath — (Optional - For use with or as an alternate to Crack Suppression Mat (CSM) or Maxxon Reinforcement (MR)) - 3/8 in. expanded galvanized steel diamond mesh, 3.4 lbs/sq yd loose laid over the floor mat material. Floor topping thickness shall be min 1-1/2 in.

System No. 9

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1000 psi. Mixture shall consist of 5 to 8 gal of water to 80 lbs of floor topping mixture to 2.1 cu ft of sand.

ULTRA QUIET FLOORS — UQF-A, UQF-Super Blend, UQF-Plus 200

System No. 10

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

FORMULATED MATERIALS LLC — Types FR-25, FR-30, and SiteMix

Alternate Floor Mat Material* — (Optional) Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 3/4 in.

FORMULATED MATERIALS LLC — Types M1, M2, M3, R1, and R2

System No. 11

Subflooring — Min 1 by 6 in. T & G lumber fastened diagonally to trusses, or min 15/32 in. thick plywood or min 7/16 in. thick oriented strand board (OSB) wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Finish Floor - Mineral and Fiber Board* — Min 1/2 in. thick, supplied in sizes ranging from 3 ft by 4 ft to 8 ft by 12 ft. All joints to be staggered a min of 12 in. with adjacent sub-floor joints.

HOMASOTE CO — Type 440-32 Mineral and Fiber Board

System No. 12

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

ACG MATERIALS — Accu-Crete types NexGen, Green, Prime, B, M, and PrePour, AccuRadiant, AccuLevel types G40, G50 and SD30.

Alternate Floor Mat Material* — (Optional) — Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 3/4 in.

ACG MATERIALS — AccuQuiet types P80, C40, D13, D-18, D25, DX38, EM.125, EM.125S, EM.250, EM.250S, EM.375, EM.375S, EM.750, and EM.750S.

System No. 13

Subflooring — Min 15/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the joists with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) — Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See **Floor- and Roof-Topping Mixtures** (CCOX) category for names of Classified Companies.

Floor Mat Materials* — (Optional) — Nom. 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 55/025 and Quiet Qurl 55/025 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 60/040 and Quiet Qurl 60/040 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 65/075, Quiet Qurl 65/075 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 52/013 and Quiet Qurl 52/013 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/4 in. entangled net core with a compressible fabric attached to the bottom loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Quiet Qurl 55/025 MT and Quiet Qurl 55/025 N MT

System No. 14

Subflooring — Min 23/32 in. thick T&G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Gypsum Board* — One layer of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists. Gypsum board secured with 1 in. long No. 6 Type W bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

Floor Mat Materials* — (As an alternate to the single layer gypsum board) — Floor mat material loose laid over the subfloor.

MAXXON CORP — Type Acousti-Mat I, Acousti-Mat II, Acousti-Mat II HP, Acousti-Mat 3, Acousti-Mat 3 HP, Enkasonic 9110, Enkasonic 9110 HP, Acousti-Mat LP, Acousti-Mat LP-R.

Gypsum Board* — (For use when floor mat is used) Two layers of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists on top of the floor mat material. Gypsum board secured to each other with 1 in. long No. 6 Type G bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches in between layers and from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

System No. 15

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

DEPENDABLE LLC — GSL M3.4, GSL K2.6, GSL-CSD and GSL RH

Floor Mat Materials* — (Optional) — Nom. 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 55/025 and Quiet Qurl 55/025 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 60/040 and Quiet Qurl 60/040 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 65/075, Quiet Qurl 65/075 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 52/013 and Quiet Qurl 52/013 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/4 in. entangled net core with a compressible fabric attached to the bottom loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Quiet Qurl 55/025 MT and Quiet Qurl 55/025 N MT

System No. 16

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the joists with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) — Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See **Floor- and Roof-Topping Mixtures** (CCOX) category for names of Classified Companies.

Floor Mat Materials* — (Optional) — Nom 3/32 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

PLITEQ INC — Type GenieMat RST02

Floor Mat Materials* — (Optional) — Nom 3/16 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

PLITEQ INC — Type GenieMat FF04

Floor Mat Materials* — (Optional) — Nom 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

PLITEQ INC — Type GenieMat FF06

Floor Mat Materials* — (Optional) — Nom 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

PLITEQ INC — Type GenieMat FF10

Floor Mat Materials* — (Optional) — Nom 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

PLITEQ INC — Type GenieMat FF17

Floor Mat Materials* — (Optional) — Nom 1 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

PLITEQ INC — Type GenieMat FF25

System No. 17

Subflooring — Nom. 1-1/2 in. thick T & G laminated composite plywood sub-floor panels to be perpendicular to the trusses with end joints staggered 4 ft. End joints centered over top chord of trusses. Subfloor panels secured to trusses with construction adhesive and #8 by 3 in. wood screws spaced 12 in. OC in the field and 6 in. OC at the end joints.

RSP INDUSTRIES INC — SAP board

System No. 18

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss.

Wall and Partition Facings and Accessories* - Sound Barrier (Optional) — Acoustic Sleeper pads stapled to the top of the subfloor and centered over wood trusses. Acoustic Sleeper pads are to be spaced appropriately so that the finish floor panels are fastened through Acoustic Sleeper pads to the trusses.

STC ARCHITECTURAL PRODUCTS L L C DBA STC SOUND CONTROL — Acoustic Sleeper

Finish Floor — - Min 15/32 in. thick wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Butt joints of panels have the option of being sealed with any UL Classified caulk or sealant found under - Fill, Void or Cavity Materials* (XHHW).

2. **Trusses** — Parallel chord trusses, spaced a max 24 in. OC, fabricated from nom 2 by 4 in. lumber with lumber oriented vertically or horizontally. Min truss depth is 12 in. when item 9 is not employed. Min truss depth is 18 in. when item 9 is employed. Truss members secured together with min No. 20 MSG galv steel truss plates. Plates have 5/16 in. long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split-tooth-type plate. Each tooth has a chisel point on its outside edge. These points are diagonally opposite each other for each pair. The top half of each tooth has a twist for stiffness. The pairs are repeated on approx 7/8 in. centers with four rows of teeth per in. of plate width.

3. **Furring Channels** — Furring channels, 7/8 in. deep by 2-9/16 in. or 2-11/16 in. or 2-23/32 in. wide at the base and 1-7/16 in. wide at the face, formed from No. 25 ga galv steel, spaced 24 in. OC perpendicular to trusses. Channels secured to trusses with double strand of No. 18 SWG galv steel wire spaced 48 in. OC. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Two furring channels used at end joints of gypsum board (Item 4), each extending a min of 6 in. beyond both side edges of the board.

3A. **Resilient Channels** — (Not Shown) — As an alternate to Item 3, resilient channel formed from No. 26 MSG galv steel, spaced 16 in. OC perpendicular to trusses. Channels secured to each truss with 1-1/4 in. long No. 6 Type S bugle head steel screw. Channels overlapped at splices 4 in. Two resilient channels used at end joints of gypsum board (Item 4), each extending a min of 6 in. beyond both side edges of the board. When foamed plastic insulation (Item 7E) is applied to the underside of the subflooring, resilient channels shall be spaced maximum 12 in. OC.

3B. **Steel Framing Members*** — (Optional) — Used as an alternate method to attach furring channels to trusses (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to the bottom chord of alternating trusses with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to the bottom chord of alternating trusses with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item 3. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two min 7/16 in. long No. 6 self-tapping framing screws, at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. When Fiber, Sprayed (Item 6) is used, furring channel spacing reduced to 16 in. OC and two layers of nom 5/8 in. thick, 4 ft wide gypsum board shall be installed as described in Item 4.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75).

3C. **Steel Framing Members*** — (Optional, Not Shown) — Used as an alternate method to attach furring channels to trusses. Clips spaced 48 in. OC, and secured to the bottom chord to alternating trusses with two No. 8 x 2-1/2 in. coarse drywall screws, one through the hole at each end of the clip. Furring channels are friction fitted into clips. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. Two layers of gypsum board required as described in Item 4. Not evaluated for use with Item 6. When Item 3C is used and Batts and Blankets* are added per Section III Item 18 Blanket Insulation in the General Information of this Directory (BXUV), clips spaced 48 in. OC, furring channels spaced 16 in. OC max, 3-1/2 in. max. Batts and Blankets* secured to plywood subfloor with staples spaced 12 in. OC or to the trusses with 0.090 in. diam galv steel wires spaced 12 in. OC, and two layers of gypsum board required as described in Item 4A. When the Batts and Blankets* are draped over the furring channel/gypsum panel ceiling membrane, the clip spacing shall be reduced to 24 in. OC and secured to consecutive trusses, the furring channel spacing shall be reduced to 12 in. OC, and two layers of gypsum board required as described in Item 4A.

KINETICS NOISE CONTROL INC — Type Isomax.

3D. **Steel Framing Members*** — (Optional, Not Shown) — Used as an alternate method to attach furring channels to trusses. Clips spaced 48 in. OC. and secured to the bottom chord to alternating trusses with one No. 8 x 2-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. Not evaluated for use with Item 6.

PLITEQ INC — Type Genie Clip

3E. **Steel Framing Members*** — (Optional, Not Shown) — Used as an alternate method to attach furring channels to trusses. Clips spaced at 48" OC and secured to the bottom of the trusses with one 2 in. Coarse Drywall Screw with 1 in. diam. washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire. Additional clips are required to hold the Gypsum Butt joints as described in item 4. Not evaluated for use with Item 6.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237 or A237R

3F. **Resilient Channels** — Resilient channels, formed from No. 25 MSG galv steel and shaped as shown, spaced 12 in. OC perpendicular to joist. Channels overlapped 4 in. at splices and secured to each joist with 1-1/4 in. Type S screws. Min end clearance of channels to wall to be 1/2 in. Additional resilient channels positioned so as to coincide with end joints of gypsum board (Item 4B).

3G. **Resilient Channels** — For Use With Item 4C - Formed from min 25 MSG galv steel installed perpendicular to trusses and spaced 16 in. OC. Channels secured to each truss with 1-5/8 in. long Type S bugle head steel screws. Channels overlapped 4 in. at splices. Two channels, spaced 6 in. OC, oriented opposite each gypsum panel end joint. Additional

channels shall extend min 6 in. beyond each side edge of panel. Insulation, Item 7C is applied over the resilient channel/gypsum panel ceiling membrane.

4. Gypsum Board* — One layer of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to furring or resilient channels. Gypsum board secured with 1 in. long No. 6 Type S bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. End joints secured to both resilient channels as shown in the end joint detail. When **Steel Framing Members** (Item 3B) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimension perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long No. 6 Type S bugle head screws spaced 12 in. OC in the field of the board. Gypsum board butt joints shall be staggered 2 ft within the assembly, and shall occur between the main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels at each butt joint shall be spaced approximately 3-1/2 in. OC, and be attached to the bottom chord of the truss with one RSIC-1 clip at each end of the channel. Screw spacing along the gypsum board butt joint shall be 8 in. OC. When both **Steel Framing Members** (Item 3B) and **Fiber, Sprayed** (Items 6 or 6A) are used, furring channel spacing reduced to 16 in. OC and two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimension perpendicular to furring channels. Base layer secured to furring channels with nom 1 in. long No. 6 Type S bugle head screws spaced 12 in. OC in the field of the board. Gypsum board butt joints shall be staggered 2 ft within the assembly, and shall occur between the main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels at each butt joint shall be spaced approximately 3-1/2 in. OC, and be attached to the bottom chord of the truss with one RSIC-1 clip at each end of the channel. Screw spacing along the gypsum board butt joint shall be 8 in. OC. Outer layer secured to furring channels using 1-5/8 in. long No. 6 Type S screws spaced 8 in. OC and 1-1/2 in. from the end joint. Butted end joints to be offset a min. of 8 in. from base layer end joints. Butted side joints of outer layer to be offset min. 18 in. from butted side joints of base layer. When **Steel Framing Members** (Item 3C) are used, two layers of nom 5/8 in. thick, 4 ft wide are installed with long dimensions perpendicular to furring channels. Base layer attached to the furring channels using 1 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field of the board. Butted end joints shall be staggered min 2 ft. within the assembly, and occur midway between the continuous furring channels. Each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels shall be spaced approximately 4 in. OC, and be attached to underside of the truss with one Isomax clip at each end of the channel. Screw spacing along the gypsum board butt joint shall be 8 in. OC. Outer layer attached to the furring channels using 1-5/8 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field. The end of the outer layer boards at the butt joint shall be attached to the base layer boards with 1-5/8 in. long Type G screws spaced 8 in. OC and 1-1/2 in. from the end joint. Butted end joints to be offset a min of 8 in. from base layer end joints. Butted side joints of outer layer to be offset min 18 in. from butted side joints of base layer. When **Steel Framing Members** (Item 3D) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 16 in. within the assembly. . At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. These additional furring channels shall be attached to underside of the truss with Genie clips as described in Item 3D. Screw spacing along the gypsum board butt joint shall be 6 in. OC. When **Steel Framing Members** (Item 3E) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 3 in. on each end. The two support furring channels shall be spaced approximately 3 in. in from joint. Screw spacing along the gypsum board butt joint and along both additional channels shall be 8 in. OC. Additional screws shall be placed in the adjacent section of gypsum board into the aforementioned 3 in. extension of the extra butt joint channels as well as into the main channel that runs between . Butt joint furring channels shall be attached with one RESILMOUNT Sound Isolation Clip at each end of the channel. When **Fiber, Sprayed** (Items 6 or 6A) is used, two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimensions perpendicular to furring channels. Base layer gypsum board secured with 1 in. long No. 6 Type S bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. End joints secured to both resilient channels as shown in the end joint detail. Outer layer gypsum board secured with 1-5/8 in. long No. 6 Type S bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. Outer layer shall be finished as described in Item 5. When **Foamed Plastic** insulation (Item 7E) is applied to the underside of the subflooring, screw spacing shall be reduced to 8 in. OC with minimum 1-1/4 in. long Type S screws to install gypsum to the resilient channels (Item 3A). Resilient channels (Item 3A) to be spaced maximum 12 in. OC. Butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. End joints secured to both resilient channels as shown in end joint detail.

AMERICAN GYPSUM CO — Type AG-C

CERTAINTED GYPSUM INC — Types FRPC, Type C, Type X-2

CGC INC — Types C, IP-X2, IPC-AR

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

NATIONAL GYPSUM CO — Types xP-C, FSK-C, FSW-C, FSW-G

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

4A. **Gypsum Board** — For use when Item 3C is used and **Batts and Blankets*** are secured to the plywood subfloor, to the trusses or draped over the furring channel/gypsum panel ceiling membrane as described in Item 3C. For method of gypsum board installation, see Item 4.

CGC INC — Types C, IP-X2, IPC-AR

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

4B. **Gypsum Board*** — For use when **Batts and Blankets*** (Item 7A) and Resilient Channels (Item 3F) are used. Nom 5/8 in. thick, 4 ft wide gypsum board installed with long dimension perpendicular to resilient channels. Nom 1 in. long No. Type S bugle head screws are driven through channel spaced 8 in. OC. End joints of gypsum board similarly fastened to additional resilient channels positioned at end joint locations.

AMERICAN GYPSUM CO — Type AG-C.

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC-C/A

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C

4C. **Gypsum Board*** — For use with Items 3G and 7C. Nom 5/8 in. thick, 48 in. wide gypsum panels installed with long dimension perpendicular to resilient channels. Gypsum panels secured with 1 in. long Type S bugle head steel screws spaced 8 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. Finish Rating with this ceiling system is 20 min.

UNITED STATES GYPSUM CO — Type ULIX

4D. **Gypsum Board*** — For use when Flooring System (Item 1) consists of both System No. 1 and min 15/32 in. plywood, min grade "Underlayment" or "Sturd-I-Floor" with T & G edges and conforming with PS1-83 specifications, or min 3/4 in. thickness of any Floor Topping Mixture (CCOX) bearing the UL Classification Marking as to Fire Resistance, min Truss depth (Item 2) is 18 in. and Batts and Blankets (Item 7D) and Resilient Channels (Item 3A) are used. One layer of nom 5/8 in. thick, 48 in. wide gypsum board installed with long dimension perpendicular to resilient channels. Gypsum board secured with 1 in. long Type S bugle head steel screws. Screws spaced 1 in. from side joints, and 12 in. OC in the rest of the field. Screws spaced 1-1/2 in. from the end joints. End joints secured to both resilient channels as shown in end joint detail. When batt insulation (Item 7D) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel (Item 3A) spacing shall be reduced to 12 in. OC., and gypsum board screws spaced 1 in. from side joints, and 8 in. OC in the rest of the field. For use only with Ceiling Damper described in Item 9R.

PANEL REY S A — Type PRC2

5. **Finishing System** — (Not Shown) — Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads. Nom 2 in. wide paper tape embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board.

6. **Fiber, Sprayed*** — (Dry Dense Packed 100% Borate Formulation) — (Not Shown, Optional) — The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product. When Item 6 (Fiber, Sprayed, Dry Dense Packed) is used, Furring Channels (Item 3F) or Resilient Channels (Item 3A) spacing shall be reduced to 12 in. OC. When Item 6 (Fiber, Sprayed, Dry Dense Packed) is used, two layers of gypsum board required as described in Item 4. Not evaluated for use with Item 3C.

U S GREENFIBER L L C — INS735, INS745, INS765LD & INS770LD to be used with dry application only.

6A. **Fiber, Sprayed*** — (Loose Fill 100% Borate Formulation) — (Not Shown, Optional) — The finished rating when Fiber, Sprayed is used has not been determined. The fiber is applied without water or adhesive at a minimum dry density of 0.5 lb/ft³ and at a max thickness of 3-1/2 in., in accordance with the application instructions supplied with the product. When Item 6A (Fiber, Sprayed, Loose Fill) is used, Furring Channels (Item 3F) or Resilient Channels (Item 3A) spacing shall be reduced to 12 in. OC. When Item 6A (Fiber Sprayed, Loose Fill) is used, two layers of gypsum board required as described in Item 4. Not evaluated for use with Item 3C.

U S GREENFIBER L L C — INS735, INS745, INS765LD & INS770LD to be used with dry application only.

7. **Batts and Blankets*** — (Not Shown) — For use with Item 3D — Nom 3 in. thick mineral wool insulation held suspended in the concealed space with 0.090 in. diam galv steel wires attached to the wood trusses at 18 in. OC.

7A. **Batts and Blankets*** — For Use With Items 3F and 4B — Glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance having a min. density of 0.5 pcf, draped over the resilient channel/gypsum panel ceiling membrane. No limit on overall thickness.

7B. **Batts and Blankets*** — (Not Shown) — For use with Item 3E — Nom 3-1/2 in. thick, min. 2 pcf fiber glass insulation held suspended in the concealed space with nominal 0.090 in. diam galv steel wires attached to the wood trusses at nominally 16 in. OC.

7C. **Cavity Insulation - Batts and Blankets* or Fiber, Sprayed*** — (As described above) in Items 7 through 7B) — (For Use with Item 4C, Not Shown) — Min. 3-1/2 in thick with no limit on maximum thickness fitted in the concealed space, draped over the resilient channel (Item 3G)/gypsum board (Item 4C) ceiling membrane.

7D. **Batts and Blankets*** — For Use With Item 4D — Insulation may be secured to plywood subfloor with staples spaced 12 in. OC or to the trusses with 0.090 in. diam galv steel wires spaced 12 in. OC. Insulation may alternatively be draped over the resilient channels and gypsum board ceiling membrane, and the resilient channels and gypsum board attachment shall be modified as specified in Item 4D. Any glass fiber insulation bearing the UL Classification Marking for Surface Burning Characteristics and/or Fire Resistance, and having a min density of 0.5 pcf and max thickness of 3-1/2 in. may be used.

7E. **Foamed Plastic*** — (As alternate to Item 6 and 6A, Not Shown) — Spray foam insulation applied directly to the underside of the plywood subflooring. Spray foam insulation installed to a maximum thickness of 10 in. at a nominal 0.5 lb/ft³ or 2.0 lb/ft³ density, depending on the product installed. Spray foam insulation is limited to use with minimum 18 in. deep trusses (Item 2). When spray foam insulation is installed, resilient channels (Item 3A) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 4) spaced maximum 3 in. away from gypsum butt joints. Gypsum board (Item 4) to be installed using minimum 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a fire damper (Item 9) in the concealed space, minimum 1 in. clearance to be maintained between damper housing and spray foam insulation. Not evaluated for use with Items 3, 3B through 3F, 3G, 6, 6A, 7 through 7D. Not evaluated with Flooring System (Item 1) Configuration No. 1.

BASF CORP — Enertite® NM, Enertite® G, FE178®, Spraytite® 178, Spraytite® 81206, Walltite® 200, Walltite® US, Walltite® US-N, and Walltite® HP+

8. **Air Duct*** — (Optional) — Any UL Class 0 or Class 1 flexible air duct installed in accordance with the instructions provided by the damper manufacturer.

9. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max. nom area shall be 349 sq in. Max. overall length and width shall not exceed 18-11/16 in. by 18-11/16 in. with max. 16 in. by 16 in. register opening. Aggregate damper openings shall not exceed 175 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. An aluminum or steel grille (Item 10) shall be installed in accordance with installation instructions.

MIAMI TECH INC — Model Series RxCRD, RxCRDS or RxCRPD

9A. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max damper assembly size nom 18 in. long by 18 in. wide and 4-1/4 in. high, or 8 in. diam. fabricated from galv steel. Aggregate damper openings shall not exceed 162 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

RUSKIN COMPANY — Model CFD7T or CFDR7T

9B. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max damper assembly size nom 18 in. long by 18 in. wide and 4-1/4 in. high, or 8 in. diam. fabricated from galv steel. Aggregate damper openings shall not exceed 162 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

LAU INDUSTRIES INC — Model CCD7T or CCDR7T

9C. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 12 in. diameter damper with insulated register box assembly. The maximum size of the register box assembly is nom. 20 in. long by 20 in. wide and 4 in. high fabricated from galv steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Series 57

9D. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 20 in. long by 16 in. wide by 4 in. high rectangular damper with duct board plenum box assembly. The maximum outer dimensions of the plenum box assembly are 23-1/2 in. long by 19-1/2 in. wide and 17 in. high fabricated from 6pcf, 1-1/2 to 2 in. thick Knauf Air Duct Board M*. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 160 sq in. per 100 sq ft ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Series 58

9E. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 14 in. long by 14 in. wide by rectangular damper with 90° boot. The maximum size of damper/boot assembly is 14 in. long by 14 in. wide and 18 in. high fabricated from galv steel. The aggregate area of the register opening(s) through the ceiling membrane shall not exceed 98 sq in. per 100 sq ft ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Models 50 w/ Boot, 50EA w/ Boot, 51 w/Boot, 50 w/ Box, 50EA w/ Box or 51 w/Box

9F. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8.) — For use with min 18 in. deep trusses Not for use with flooring system 1 or 17. Max plenum box size nom 19 in. long by 19 in. wide and 11-7/8 in. high fabricated from galv steel. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

LLOYD INDUSTRIES INC — Model CRD 50-BT, CRD 50-EA-BT, CRD 55-BT, CRD 55 EA-BT

9G. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 8). For use with min 18 in. deep trusses Not for use with flooring system 1 or 17. Max plenum box size nom 13 in. long by 13 in. wide and 11-7/8 in. high fabricated from galv steel. Aggregate damper openings shall not exceed 50 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

LLOYD INDUSTRIES INC — Model CRD 50-BT-6, CRD 50-EA-BT-6, CRD 55-BT-6, CRD 55 EA-BT-6

9H. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 103 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 10-1/8 in. Aggregate damper openings shall not exceed 52 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 10) shall be installed in accordance with installation instructions.

PANASONIC CORPORATION, PANASONIC CORPORATION OF NORTH AMERICA — Model PC-RD05C5

9I. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 113 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 11-1/8 in. Aggregate damper openings shall not exceed 57 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 10) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDFUWT

9J. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 79 sq in. with the length not to exceed 10 in. and the width not to exceed 7-15/16 in. Aggregate damper openings shall not exceed 40 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A metallic grille (Item 10) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Models RDJ1 and RDH

9K. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 8). For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max plenum box size nom 19 in. long by 19 in. wide and 11-7/8 in. high fabricated from galv steel. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

METAL-FAB INC — Models MSCD-HC and MRCD-HC

9L. **Alternate Ceiling Damper*** — (Optional, To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 87 sq in. with the length not to exceed 9 in. and the width not to exceed 9-11/16 in. Aggregate damper openings shall not exceed 44 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 10) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDMWT

9M. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8) — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom 21 in. long by 18 in. wide, fabricated from galvanized steel. Plenum box max size nom 21 in. long by 18 in. wide by 14 in. high (inner dimension) fabricated from either galvanized steel or min 1 in. thick Listed Duct Board bearing the UL Listing Marking having a min R-Value of 4.3. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 180 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-1WT

9N. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8) — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom 12 in. long by 12 in. wide with an 8 in. diameter damper, fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 72 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-2WT

9O. Alternate Ceiling Damper* — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 324 sq in. with the length not to exceed 24 in. and the width not to exceed 20 in. Max height of damper shall be 14 in. Aggregate damper openings shall not exceed 162 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 10) shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Model RD-521

POTTORFF — Model CFD-521

9P. Alternate Ceiling Damper* — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 196 sq in. with the length not to exceed 26 in. and the width not to exceed 14 in. Max height of damper shall be 7 in. Aggregate damper openings shall not exceed 98 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 10) not to exceed 144 in.² shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Model RD-521-BT

POTTORFF — Model CFD-521-BT

9Q. Alternate Ceiling Damper* — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 256 sq in. with the length not to exceed 24 in. and the width not to exceed 20 in. Max height of damper shall be 17 in. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 10) shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Models RD-521-IP, RD-521-NP

POTTORFF — Models CFD-521-IP, CFD-521-NP

9R. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with Item 4D only. Not for use with flooring system 1. Max nom 8 in. diameter by 3-1/8 in. high, fabricated from galvanized steel. Plenum box max size nom 12 in. long by 12 in. wide by 3 in. high fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 72 sq in. per 100 sq ft of ceiling area.

NAILOR INDUSTRIES INC — Types 0755, 0755A

10. Grille — Aluminum or Steel grille, installed in accordance with the installation instructions provided with the ceiling damper.

11. Discrete Products Installed in Air-handling Spaces* — Automatic Balancing Valve/Damper — (Not Shown - Optional) — For use with item 9A, Ruskin Company's Model CFD7T damper (CABS). Ceiling damper to be provided with plenum box per damper manufacturer's instructions with side outlet only. Entire assembly to be installed into any UL Class 0 or Class 1 flexible air duct in accordance with the instructions provided by the automatic balancing valve/damper manufacturer.

METAL INDUSTRIES INC — Model ABV-4, ABV-5, ABV-6

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2018-06-22

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BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

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 Design Criteria and Allowable Variances](#)

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Design No. L546

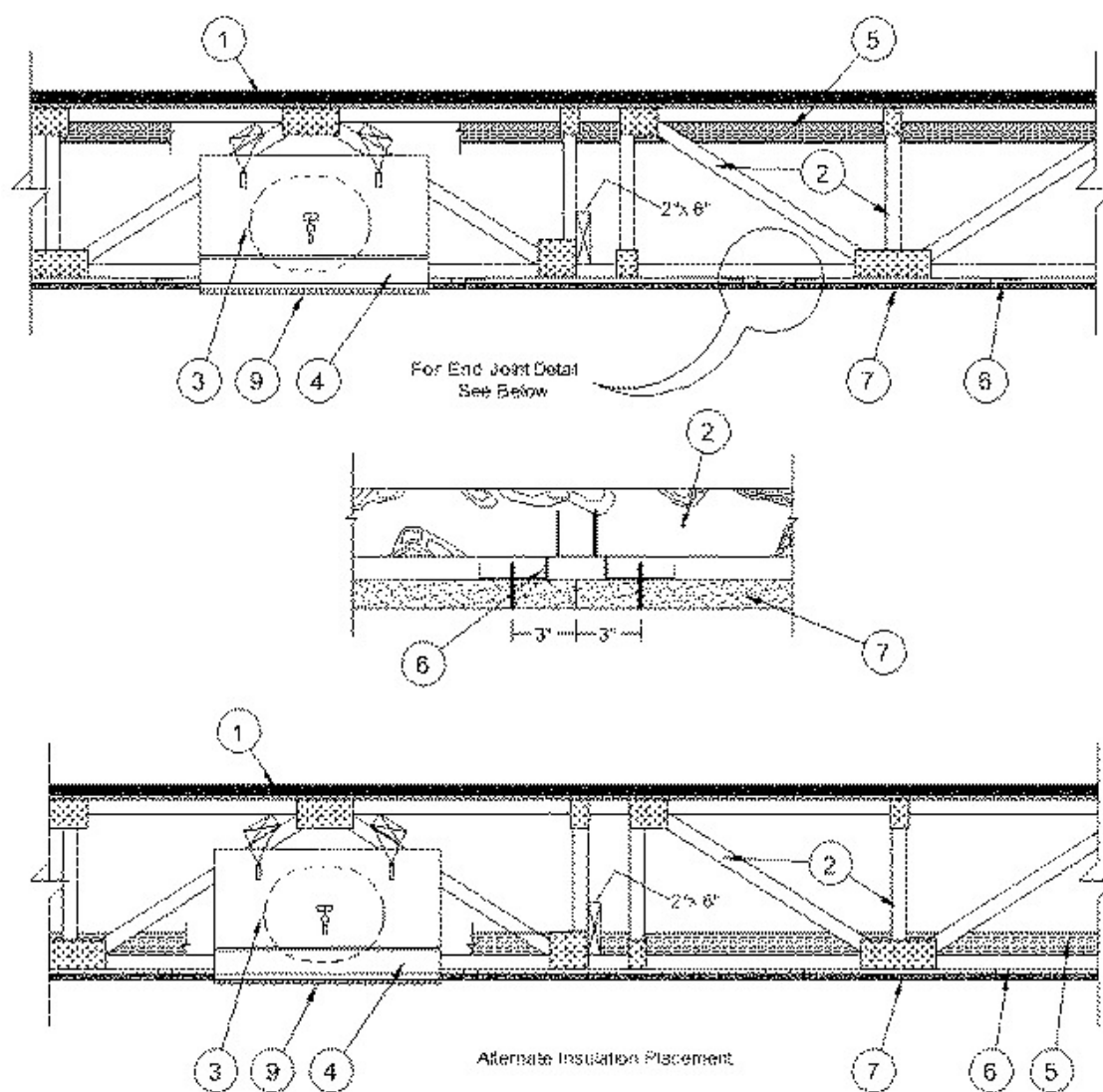
April 04, 2018

Unrestrained Assembly Rating — 1 Hr

Finish Rating — 24 or 25 Min (See Item 5)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide **BXUV or **BXUV7****

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Flooring System** — The flooring system shall consist of one of the following:

System No. 1

Subflooring — Min 15/32 or 19/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Finish Flooring - Floor Topping Mixture* — Min 3/4 thickness of floor topping mixture having a minimum compressive strength of 1500 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

MAXXON CORP — Types D-C, GC, GC 2000, L-R, T-F, CT, SS

RAPID FLOOR SYSTEMS — Types RF, RFP, RFU, Orcrete

Floor Mat Materials* — (Optional) — Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

MAXXON CORP — Type Acousti-Mat I, Acousti-Mat II, Acousti-Mat II HP, Enkasonic 9110, Enkasonic 9110 HP, Acousti-Mat 3, Acousti-Mat 3 HP, Acousti-Mat LP, Acousti-Mat LP-R, Acousti-Mat SD.

Floor Mat Reinforcement — (Optional) - Refer to manufacturer's instructions regarding minimum thickness of floor topping over each floor mat material, primers, and use of crack suppression reinforcement.

MAXXON CORP — Crack Suppression Mat (CSM) or Maxxon Reinforcement (MR)

Metal Lath — (Optional - For use with or as an alternate to Crack Suppression Mat (CSM) or Maxxon Reinforcement (MR))
— 3/8 in. expanded galvanized steel diamond mesh, 3.4 lbs/sq yd loose laid over the floor mat material. Floor topping thickness shall be min 1-1/2 in.

System No. 2

Subflooring — Min 1 by 6 in. T & G lumber fastened diagonally to joists, or min 15/32 in. thick plywood or min 7/16 in. thick oriented strand board (OSB) wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Finish Floor — Mineral and Fiber Board* — Min 1/2 in. thick, supplied in sizes ranging from 3 ft by 4 ft to 8 ft by 12 ft. All joints to be staggered a min of 12 in. with adjacent sub-floor joints.

HOMASOTE CO — Type 440-32 Mineral and Fiber Board

System No. 3

Subflooring — Min 15/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Nom 0.030 in thick commercial asphalt saturated felt.

Finish Flooring — Floor Topping Mixture* — Min 1-1/2 in. thickness of floor topping mixture having a min compressive strength of 1000 psi and a cast density of 100 plus or minus 5 pcf. Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mixture shall consist of 1.4 cu feet of preformed foam concentrate to 94 lbs Type I Portland cement, 300 lbs of sand with 5-1/2 gal of water.

ELASTIZELL CORP OF AMERICA — Type FF

System No. 4

Subflooring — Min 15/32 or 19/32 in. thick wood structural panels, min grade C-D or Sheathing. Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Vapor Barrier — (Optional) Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring — Floor Topping Mixture* — Min 3/4 or 1 in. thickness of floor topping mixture for 19/32 or 15/32 in. thick wood structural panels respectively, having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

FORMULATED MATERIALS LLC — Types FR-25, FR-30, and SiteMix

Alternate Floor Mat Material* — (Optional) Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 3/4 in. or 1 in. thickness of floor topping for 19/32 or 15/32 in. thick wood structural panels respectively.

FORMULATED MATERIALS LLC — Types M1, M2, M3, R1, and R2

System No. 5

Subflooring — Min 15/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Floor Mat Materials* — (Optional) — Floor mat material nom 5/64 in. (2 mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1 in. of floor-topping mixture.

ECORE INTERNATIONAL INC — Type QTscu 4002

HACKER INDUSTRIES INC — Type Hacker Sound-Mat.

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/4 in. (6 mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1-1/4 in. (32 mm) of floor-topping mixture.

ECORE INTERNATIONAL INC — Type QTrbm 3006-3

HACKER INDUSTRIES INC — Type Hacker Sound-Mat II.

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/8 in. (3mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 3/4 in. (19 mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 125

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/4 in. (6 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1 in. (25 mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 250, Quiet Qurl 55/025

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 3/8 in. (10 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/4 in. (32mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 400, Quiet Qurl 60/040

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 3/4 in. (19 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/2 in. (38mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 750, Quiet Qurl 65/075

Metal Lath — (Optional) — For use with 3/8 in. (10 mm) floor mat materials, 3/8 in. expanded steel diamond mesh, 3.4 lbs/sq yd placed over the floor mat material. Hacker Floor Primer to be applied prior to the placement of the metal lath. When metal lath is used, floor topping thickness a nom 1-1/4 in. over the floor mat.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1100 psi. Mixture shall consist of 6.8 gal of water to 80 lbs of floor topping mixture to 1.9 cu ft of sand.

HACKER INDUSTRIES INC — Firm-Fill Gypsum Concrete, Firm-Fill 2010, Firm-Fill 3310, Firm-Fill 4010, Firm-Fill High Strength, Gyp-Span Radiant

System No. 6

Subflooring — Min 15/32 or 19/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Vapor Barrier — (Optional) — Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring — Floor Topping Mixture* — Min 3/4 or 1 in. thickness of floor topping mixture for 19/32 or 15/32 in. thick wood structural panels respectively, having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

ACG MATERIALS — Accu-Crete types NexGen, Green, Prime, B, M, and PrePour, AccuRadiant, AccuLevel types G40, G50 and SD30.

Alternate Floor Mat Material* — (Optional) — Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 3/4 in. or 1 in. thickness of floor topping for 19/32 or 15/32 in. thick wood structural panels respectively.

ACG MATERIALS — AccuQuiet types P80, C40, D13, D-18, D25, DX38, EM.125, EM.125S, EM.250, EM.250S, EM.375, EM.375S, EM.750, and EM.750S.

System No. 7

Subflooring — 15/32 or 19/32 in. thick wood structural panels, min. grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to joists with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Compressive strength to be 2100 psi min. Thickness to be 3/4 in. min for 19/32 in thick wood structural panels or 1 in. min. for 15/32 in thick wood structural panels. Refer to manufacturer's instructions accompanying the material for specific mix design.

System No. 8

Subflooring — Min 15/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Nom 0.010 in. thick commercial asphalt saturated felt.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a minimum compressive strength of 1800 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

UNITED STATES GYPSUM CO — Types LRK, HSLRK, CSD

USG MEXICO S A DE C V — Types LRK, HSLRK, CSD

Floor Mat Materials* — (Optional) — Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

UNITED STATES GYPSUM CO — Types SAM, LEVELROCK® Brand Sound Reduction Board, LEVELROCK® Brand Floor Underlayment SRM-25

Alternate Floor Mat Materials* — (Optional) - Nom 3/8 in. thick floor mat material loose laid over the subfloor.

GRASSWORX L L C — Type SC50

System No. 9

Subflooring — Min 23/32 in. thick T&G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Gypsum Board* — One layer of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists. Gypsum board secured with 1 in. long No. 6 Type W bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

Floor Mat Materials* — (As an alternate to the single layer gypsum board) — Floor mat material loose laid over the subfloor.

MAXXON CORP — Type Acousti-Mat I, Acousti-Mat II, Acousti-Mat II HP, Acousti-Mat 3, Acousti-Mat 3 HP, Enkasonic 9110, Enkasonic 9110 HP, Acousti-Mat LP, Acousti-Mat LP-R.

Gypsum Board* — (For use when floor mat is used) Two layers of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists on top of the floor mat material. Gypsum board secured to each other with 1 in. long No. 6 Type G bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches in between layers and from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

System No. 10

Subflooring — Min 15/32 or 19/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Vapor Barrier — (Optional) — Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring — Floor Topping Mixture* — Min 3/4 or 1 in. thickness of floor topping mixture for 19/32 or 15/32 in. thick wood structural panels respectively, having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

DEPENDABLE LLC — GSL M3.4, GSL K2.6, GSL-CSD and GSL RH.

Floor Mat Materials* — (Optional) — Nom. 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 55/025 and Quiet Qurl 55/025 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 60/040 and Quiet Qurl 60/040 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 65/075, Quiet Qurl 65/075 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 52/013 and Quiet Qurl 52/013 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/4 in. entangled net core with a compressible fabric attached to the bottom loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Quiet Qurl 55/025 MT and Quiet Qurl 55/025 N MT

2. **Trusses** — Parallel chord trusses spaced a max of 24 in. OC fabricated from nom 2 by 4 lumber, with lumber oriented vertically or horizontally. Min truss depth is 18 in. Truss members secured together with min 0.036 in. thick galv steel plates. Plates have 5/16 in. long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split tooth type plate. Each tooth has a chisel point on its outside edge with these points being diagonally opposite each other for each pair. The top half of each tooth has a twist for stiffness. The pairs are repeated on approximately 7/8 in. centers with four rows of teeth per inch of plate width.

3. **Air Duct*** — (Optional) — Any UL Class 0 or Class 1 flexible air duct installed in accordance with the instructions provided by the damper manufacturer

4. **Ceiling Damper*** — (Optional. To be used with Air Duct Item 3) — For use with min 18 in. deep trusses. Max nom area shall be 324 sq in. Max square size shall be 18 in. by 18 in. Rectangular sizes not to exceed 324 sq in. with a max width of 18 in. Max height of damper shall be 14 in. Aggregate damper openings shall not exceed 162 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 9) shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Model RD-521

POTTORFF — Model CFD-521

4A. **Alternate Ceiling Damper*** — Max nom area shall be 196 sq in. Max square size shall be 14 in. by 14 in. Rectangular sizes not to exceed 196 sq in. with a max width of 26 in. Max height of damper shall be 7 in. Aggregate damper openings shall not exceed 98 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 9) not to exceed 144 in.² shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Model RD-521-BT

POTTORFF — Model CFD-521-BT.

4B. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 3) — For use with min 18 in. deep trusses. Max nom area shall be 256 sq in. with the length not to exceed 24 in. and the width not to exceed 20 in. Max height of damper shall be 17 in. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 9) shall be installed in accordance with installation instructions.

POTTORFF — Models CFD-521-IP, CFD-521-NP

4C. **Alternate Ceiling Damper*** — For use with min. 18 in. deep trusses. Max. nom area shall be 349 sq in. Max. overall length and width shall not exceed 18-11/16 in. by 18-11/16 in. with max. 16 in. by 16 in. register opening. Aggregate damper openings shall not exceed 175 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. An aluminum or steel grille (Item 9) shall be installed in accordance with installation instructions.

MIAMI TECH INC — Model Series RxCRD, RxCRDS or RxCRPD

4D. **Alternate Ceiling Damper*** — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 75 sq in. with the length not to exceed 8-9/16 in. and the width not to exceed 8-3/4 in. Max height of damper shall be 9-7/8 in. Aggregate damper openings shall not exceed 38 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturers installation instructions provided with the damper. A plastic grille (Item 9) shall be installed in accordance with installation instructions.

DELTA ELECTRONICS INC — Models CRD2, GBR-CRD, ITG-CRD

4E. **Alternate Ceiling Damper*** — For use with min 18 in. deep trusses. Max nom area shall be 324 sq in. Max square size shall be 18 in. by 18 in. Rectangular sizes not to exceed 324 sq in. with a max length of 20 in. and a max width of 22 in. Max height of damper shall be 14 in. Aggregate damper openings shall not exceed 154 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturer's installation instructions provided with the damper. An aluminum or steel grille (Item 9) shall be installed in accordance with installation instructions.

UNITED ENERTECH CORP — Type C-S/R-WT or C-S/R-WTP (Max nom area 324 sq. in.) or C-S/R-WTS or C-S/R-WTPS (Max nom area 162 sq. in.)

4F. **Alternate Ceiling Damper*** — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 75 sq in. with the length not to exceed 9-1/4 in. and the width not to exceed 9-3/4 in. Max height of damper shall be 9-7/8 in. Aggregate damper openings shall not exceed 45 sq in. per 100 sq ft of ceiling area. Damper shall be installed

in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 9) shall be installed in accordance with installation instructions.

DELTA ELECTRONICS INC — Model SIG-CRD

4G. **Alternate Ceiling Damper*** — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 131 sq in. with the length not to exceed 11-1/16 in. and the width not to exceed 11-7/8 in. Aggregate damper openings shall not exceed 66 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 9) shall be installed in accordance with installation instructions.

DELTA ELECTRONICS INC — Model SMT-CRD

4H. **Alternate Ceiling Damper*** — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 103 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 10-1/8 in. Aggregate damper openings shall not exceed 52 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 9) shall be installed in accordance with installation instructions.

PANASONIC CORPORATION, PANASONIC CORPORATION OF NORTH AMERICA — Model PC-RD05C5

4I. **Alternate Ceiling Damper*** — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 113 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 11-1/8 in. Aggregate damper openings shall not exceed 57 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 9) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDFUWT

4J. **Alternate Ceiling Damper*** — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 79 sq in. with the length not to exceed 10 in. and the width not to exceed 7-15/16 in. Aggregate damper openings shall not exceed 40 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A metallic grille (Item 9) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Models RDJ1 and RDH

4K. **Alternate Ceiling Damper*** — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 87 sq in. with the length not to exceed 9 in. and the width not to exceed 9-11/16 in. Aggregate damper openings shall not exceed 44 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 9) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDMWT

4L. **Alternate Ceiling Damper*** — (Optional, To be used with Air Duct Item 3) — For use with min 18 in. deep trusses. Max nom 21 in. long by 18 in. wide, fabricated from galvanized steel. Plenum box max size nom 21 in. long by 18 in. wide by 14 in. high (inner dimension) fabricated from either galvanized steel or min 1 in. thick Listed Duct Board bearing the UL Listing Marking having a min R-Value of 4.3. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 180 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-1WT

4M. **Damper*** — (Optional, To be used with Air Duct Item 3) — For use with min 18 in. deep trusses. Max nom 12 in. long by 12 in. wide with an 8 in. diameter damper, fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 72 sq in. per 100 sq ft of ceiling area. .

GREENHECK FAN CORP — Model CRD-2WT

5. **Batts and Blankets*** — (Optional with Items 7 and 7B; Required with Item 7A) — Glass fiber or mineral wool insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance. When the resilient channels (Item 6) or furring channels (Item 6A) are spaced 16 in. OC, the insulation shall be a max of 3-1/2 in. thick, and shall be secured against the subflooring with staples at 12 in. OC or held suspended in the concealed space with 0.090 in. diam galv steel wires attached to the wood trusses at 12 in. OC. When the resilient channels (Item 6) or furring channels (Item 6A) are spaced a max of 12 in. OC or when the Steel Framing Members (Item 6B) are used, there is no limit in the overall thickness of insulation, and the insulation can be secured against the subflooring, held suspended in the concealed space or draped over the resilient or furring channels (or Steel Framing Members) and gypsum panel membrane. When **Steel Framing Members** (Item 6C) are used, max 3-1/2 in. thick insulation shall be draped over the furring channels (Item 6Ca) and gypsum board ceiling membrane, and friction-fitted between trusses and Steel Framing Members (Item 6Cd). The finished rating has only been determined when the insulation is secured to the subflooring.

5A. **Fiber, Sprayed*** — (Dry Dense Packed 100% Borate Formulation) — As an alternate to Item 5 — When used, the resilient channel and gypsum board attachment is modified as specified in Items 6 and 7 and wire mesh (Item 10) shall be

attached to the furring channels to facilitate installation of the material. The finished rating when Fiber, Sprayed is used has not been determined. The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product. When Item 5A (Fiber, Sprayed) is used, two layers of gypsum board required as described in Item 7. Not evaluated for use with Items 6B, 6C or 6D.

U S GREENFIBER L L C — INS735, INS745, INS765LD & INS770LD to be used with dry application only.

5B. Fiber, Sprayed* — (Loose Fill 100% Borate Formulation) — As an alternate to Items 5 and 5A — The finished rating when Fiber, Sprayed is used has not been determined. The fiber is applied without water or adhesive at a minimum dry density of 0.5 lb/ft³ and at a max thickness of 3-1/2 in., in accordance with the application instructions supplied with the product. Wire mesh (Item 10) shall be attached to the furring channels to facilitate installation of the material. When Item 5B (Fiber, Sprayed) is used, two layers of gypsum board required as described in Item 7. Not evaluated for use with Items 6B, 6C or 6D.

U S GREENFIBER L L C — INS735, INS745, INS765LD & INS770LD to be used with dry application only.

6. Furring Channels — Resilient channels, formed of 25 MSG thick galv steel, spaced 16 in. OC perpendicular to trusses. When insulation (Items 5, 5A, 5B) is draped over the resilient channel/gypsum board ceiling membrane, the spacing shall be reduced to 12 in. OC. Channels secured to each truss with 1-1/4 in. long Type S bugle head steel screws. Channels overlapped 4 in. at splices. Two channels, spaced 6 in OC, oriented opposite each gypsum board end joint as shown in the above illustration. Additional channels shall extend 6 in beyond each side edge of board.

6A. Steel Framing Members* — (Not Shown) — As an alternate to Item 6, furring channels and Steel Framing Members* as described below:

a. Furring Channels — Formed of No. 25 MSG galv steel, 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to trusses. When batt insulation (Items 5) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. Steel Framing Members* — Used to attach furring channels (Item a) to trusses (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to alternating trusses with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to alternating trusses with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item a. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 7.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75).

6B. Alternate Steel Framing Members — (Not Shown) — As an alternate to Items 6 and 6A, main runners, cross tees, cross channels and wall angle as listed below.

a. Main Runners — Nom 10 or 12 ft long, 15/16 in. or 1-1/2 in. wide face, spaced 4 ft. OC. Main runners suspended by min 12 SWG galv steel hanger wires spaced 48 in. OC. Hanger wires to be located adjacent to main runner/cross tee intersections. Hanger wires wrapped and twist-tied on 16d nails driven in to side of trusses at least 5 in. above the bottom face.

b. Cross Tees or Channels — Nom 4 ft long cross tees, with 15/16 in. or 1-1/2 in. wide face, or nom 4 ft long cross channels, with 1-1/2 in. wide face, either spaced 16 in. OC, installed perpendicular to the main runners. Additional cross tees or channels used 8 in. from each side of butted gypsum board end joints. The cross tees or channels may be riveted or screw-attached to the wall angle or channel to facilitate the ceiling installation.

c. Wall Angle or Channel — Painted or galv steel angle with 1 in. legs or channel with 1 in. legs, 1-9/16 in. deep attached to walls at perimeter of ceiling with fasteners 16 in. OC. To support steel framing member ends and for screw-attachment of the gypsum panel.

CGC INC — Type DGL or RX.

USG INTERIORS LLC — Type DGL or RX.

6C. Steel Framing Members* — (Not Shown) — As an alternate to Items 6, 6A and 6B.

a. Furring Channels — Hat-shaped furring channels, 7/8 in. deep by 2-5/8 in. wide at the base and 1-1/4 in. wide at the face, formed from No. 25 ga. galv steel, spaced max. 16 in. OC perpendicular to trusses and Cold Rolled Channels (Item 6Cb). Furring channels secured to Cold Rolled Channels at every intersection with a 1/2 in. pan head self-drilling screw through each furring channel leg. Ends of adjoining channels overlapped 4 in. and tied together with two double strand No. 18 SWG galv steel wire ties, one at each end of overlap. Supplemental furring channels at base layer and outer layer gypsum board butt joints are not required. Batts and Blankets draped over

furring channels as described in Item 5. Two layers of gypsum board attached to furring channels as described in Item 7.

b. **Cold Rolled Channels** — 1-1/2 in. by 1/2 in., formed from No. 16 ga. galv steel, positioned vertically and parallel to trusses, friction-fitted into the channel caddy on the Steel Framing Members (Item 6Cd). Adjoining lengths of cold rolled channels lapped min. 6 in. and wire-tied together with two double strand 18 SWG galv steel wire ties, one at each end of overlap.

c. **Blocking** — Where truss design does not permit direct, full contact of the hanger bracket, a piece of nominal 2 by 4 in. lumber (blocking), min. 6 in. long to permit full contact of the hanger bracket, to be secured vertically to the side of the truss (Item 2) at the top and bottom of the blocking at each Steel Framing Member (Item 6Cd) location.

d. **Steel Framing Members*** — Hangers spaced 48 in. OC. max along truss, and secured to the Blocking (Item 6Cc) on alternating trusses with a single 5/16 in. by 2 in. hex head lag bolt or four #6 1-1/4 in. drywall screws through mounting hole(s) on the hanger bracket. The two 1/4 in. long steel teeth on the hanger are embedded in the side of the blocking. Hanger positioned on blocking and leveling bolt height adjusted such that furring channels are flush with bottom of trusses before gypsum board installation. Spring gauge of hanger chosen per manufacturer's instructions.

KINETICS NOISE CONTROL INC — Type ICW.

6D. Steel Framing Members* — (Not Shown) — As an alternate to Items 6, 6A, 6B and 6C.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep, spaced 16 in. OC perpendicular to wood structural members. When insulation, Items 5 or 5A is applied over the furring channel/gypsum panel ceiling membrane, the furring channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galv steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to trusses (Item 2). Clips spaced 48 in. OC, and secured to the bottom chord of alternating trusses with two No. 8 x 2-1/2 in. course drywall screws, one through the hole at each end of the clip. When insulation, Items 5 or 5A is applied over the furring channel/gypsum panel ceiling membrane, the clip spacing shall be reduced to 24 in. OC and secured to consecutive trusses. Furring channels are friction fitted into clips. Adjoining channels are overlapped as described in Item a. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 7. Two layers of gypsum board required as described in Item 7. Not evaluated for use with Item 5B.

KINETICS NOISE CONTROL INC — Type Isomax.

6E. Steel Framing Members* — (Optional, Not Shown) — Used as an alternate method to attach min. 1/2 in. deep resilient channels (Item 6) to wood trusses (Item 2). Resilient channels are friction fitted into clips, and then clips are secured to the bottom chord of each wood truss with a min. 1-3/4 in. long Type S bugle head steel screw through the center hole of the clip and the resilient channel flange. Adjoining resilient channels are overlapped 4 in. under trusses. The clip flange is opened slightly to accommodate the two overlapped channels. Additional clips required to hold resilient channel that supports the gypsum board butt joints, as described in Item 7.

KEENE BUILDING PRODUCTS CO INC — Type RC Assurance.

6F. Steel Framing Members — (Not Shown) — As an alternate to Item 6, furring channels and Steel Framing Members* as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to trusses. When batt insulation (Items 5) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to trusses (Item 2). Clips spaced 48 in. OC. GenieClips secured to alternating joists with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. When insulation, Items 5 is applied over the furring channel/gypsum panel ceiling membrane, the clip spacing shall be reduced to 24 in. OC and secured to consecutive trusses. Furring channels are friction fitted into clips. Adjoining channels are overlapped as described in Item a. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 7. Not evaluated for use with Item 5A or 5B.

PLITEQ INC — Type GENIECLIP

6G. Alternate Steel Framing Members* — (Not Shown) — As an alternate to items 6-6F, furring channels and Steel Framing Members as described below.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-5/8 in. wide by 7/8 in deep, spaced 24 in OC, perpendicular to trusses. When batt insulation (Items 5) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to trusses (Item 2). Clips spaced at 48" OC and secured to the bottom of the joists with one 2 in. Coarse Drywall Screw with 1 in. diam washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6" and tied together with double strand of No. 18 AWG galvanized steel wire. Additional clips are required to hold the Gypsum Butt joints as described in item 7B.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237 or A237R

7. **Gypsum Board*** — Nom 5/8 in. thick, 48 in. wide gypsum board. When resilient channels (Item 6) are used, gypsum board installed with long dimension perpendicular to resilient channels. Gypsum board secured with 1 in. long Type S bugle head screws spaced 12 in. OC and located a min of 1/2 in. from side joints and 3 in. from end joints. End joints secured to both resilient channels as shown in end joint detail. When batt insulation (Item 5) is draped over the resilient channel/gypsum board ceiling membrane, screws spacing shall be 8 in. OC. When **Steel Framing Members*** (Item 6A, 6F) are used, gypsum board installed with long dimension perpendicular to furring channels and side joints of sheet located beneath joists. Gypsum board secured to furring channels with 1 in. long Type S bugle head screws spaced 12 in. OC in the field. Butted end joints shall be staggered min 2 ft within the assembly, and occur between the continuous furring channels. At butted end joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels shall be spaced approximately 3-1/2 in. OC and be attached to underside of the joist with one clip at each end of the channel. Screw spacing along the end joint shall be 8 in. OC.

AMERICAN GYPSUM CO — Type AG-C

CGC INC — Types C, IP-X2, IPC-AR

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

7A. **Gypsum Board*** — Nom 5/8 in. thick, 48 in. wide gypsum board, installed with long dimension perpendicular to resilient channels. Gypsum board secured with 1-1/8 in. long Type S bugle head screws spaced 8 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. End joints secured to both resilient channels as shown in end joint detail. When Item 7A is used, the insulation must be used and must be draped over the resilient channel/gypsum board.

NATIONAL GYPSUM CO — Types eXP-C, FSW-G, FSW-C, FSK-G, FSK-C

7B. **Gypsum Board*** — Nom 5/8 in. thick, 48 in. wide gypsum panels. When resilient channels (Item 6) are used, gypsum panels installed with long dimension perpendicular to resilient channels. Gypsum panels secured with 1 in. long Type S bugle head steel screws spaced 12 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. When insulation (Items 5 or 5A) is applied over the resilient channel/gypsum panel ceiling membrane screw spacing shall be reduced to 8 in. OC. End joints secured to both resilient channels as shown in end joint detail. When **Steel Framing Members** (Item 6A) are used, gypsum panels installed with long dimensions perpendicular to furring channels. Panels attached to the furring channels using 1 in. long Type S bugle-head steel screws spaced 8 in. OC along butted end joints and in the field of the panel. Butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. Each end of each gypsum panel shall be supported by a single length of furring channel equal to the width of the gypsum panel plus 6 in. on each end. The two support furring channels shall be spaced approximately 3-1/2 in. OC, and be attached to underside of the truss with one clip at each end of the channel. When **Steel Framing Members*** (Item 6B) are used, gypsum panels installed with long dimension perpendicular to cross tees with side joints centered along main runners and end joints centered along cross tees. Panels fastened to cross tees with 1 in. long . Type S bugle-head screws spaced in the field and 8 in. OC along end joints. Panels fastened to main runners with 1 in. long . Type S bugle-head screws spaced midway between cross tees. Screws along sides and ends of panels spaced 3/8 to 1/2 in. from panel edge. End joints of panels shall be staggered with spacing between joints on adjacent panels not less than 4 2 ft OC. When **Fiber, Sprayed** (Items 5A or 5B) is used, two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimensions perpendicular to furring channels. Base layer gypsum board secured with 1 in. long Type S bugle head steel screws spaced 12 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. End joints secured to both resilient channels as shown in end joint detail. Outer layer gypsum board secured with 1-5/8 in. long

Type S bugle head steel screws spaced 12 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. Outer layer shall be finished as described in Item 8. When both **Steel Framing Members** (Item 6A) and **Fiber, Sprayed** (Items 5A or 5B) are used, furring channels spaced 12 in. OC and two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimension perpendicular to furring channels. Base layer secured to furring channels with nom 1 in. long Type S bugle head screws spaced 8 in. OC along butted end joints and in the field of the board. Butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. Each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two support furring channels shall be spaced approximately 3-1/2 in. OC, and be attached to the underside of the truss with one clip at each end of the channel. Outer layer secured to furring channels using 1-5/8 in. long Type S screws spaced 8 in. OC and 1-1/2 in. from the end joint. Butted end joints to be offset a min. of 8 in. from base layer end joints. Butted side joints of outer layer to be offset min. 18 in. from butted side joints of base layer. When **Steel Framing Members** (Item 6C) are used, two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimensions perpendicular to furring channels (Item 6Ca). Base layer attached to the furring channels using 1 in. long Type S bugle head steel screws spaced 8 in. OC along butted end joints and 12 in. OC in the field of the board. Butted end joints centered on the continuous furring channels. Butted base layer end joints to be offset a min of 16 in. in adjacent courses. Outer layer attached to the furring channels using 1-5/8 in. long Type S bugle head steel screws spaced 8 in. OC at butted end joints and 12 in. OC in the field. Butted end joints centered on the continuous furring channels and offset a min of 16 in. from butted end joints of base layer. Butted side joints of outer layer to be offset min 16 in. from butted side joints of base layer. When **Steel Framing Members** (Item 6D) are used, two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimensions perpendicular to furring channels. Base layer attached to the furring channels using 1 in. long Type S bugle-head steel screws spaced 12 in. OC in the field of the board. Butted end joints shall be staggered min 2 ft. within the assembly, and occur midway between the continuous furring channels. Each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels shall be spaced approximately 4 in. OC, and be attached to underside of the truss with one Isomax clip at each end of the channel. Screw spacing along the gypsum board butt joint shall be 8 in. OC. Outer layer attached to the furring channels using 1-5/8 in. long Type S bugle-head steel screws spaced 12 in. OC in the field. The end of the outer layer boards at the butt joint shall be attached to the base layer boards with 1-5/8 in. long Type G screws spaced 8 in. OC and 1-1/2 in. from the end joint. Butted end joints to be offset a min of 8 in. from base layer end joints. Butted side joints of outer layer to be offset min 18 in. from butted side joints of base layer. Outer layer shall be finished as described in Item 8. When **Steel Framing Members** (Item 6F) are used, two layers of nom 5/8 in. thick, 4 ft wide are installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels using 1 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field of the board. Butted end joints shall be staggered minimum 2 ft. within the assembly. Additional furring channels constructed as per Item 6F shall be used to support each end of each gypsum board. These additional furring channels shall be attached to underside of the truss with Genie clips as described in Item 6F. Screw spacing along the gypsum board butt joint shall be 8 in. OC. Outer layer attached to the furring channels using 1-5/8 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field. The outer layer boards at the butt joint shall be attached to the base layer boards with No. 10, 1-1/2 in. long drywall screws spaced 8 in. OC and 1-1/2 in. from the end joint. Butted end joints to be offset a min of 24 in. from base layer end joints. Butted side joints of outer layer to be offset min 16 in. from butted side joints of base layer. When **Steel Framing Members** (Item 6G) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 3 in. on each end. The two support furring channels shall be spaced approximately 3 in. in from joint. Screw spacing along the gypsum board butt joint and along both additional channels shall be 8 in. OC. Additional screws shall be placed in the adjacent section of gypsum board into the aforementioned 3 in. extension of the extra butt joint channels as well as into the main channel that runs between. Butt joint furring channels shall be attached with one RESILMOUNT Sound Isolation Clip at each end of the channel.

CGC INC — Types C, IP-X2, IPC-AR

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

7C. Gypsum Board* (As an alternative to Items 7 and 7B) — Nom 5/8 in. thick, 48 in. wide gypsum board, installed and secured as described in Items 7 and 7B with max screw spacing 8 in. OC.

UNITED STATES GYPSUM CO — ULIX

8. Finishing System — (Not Shown) — Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads. Nom 2 in. wide paper tape embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board.

9. **Grille** — Grille, installed in accordance with the installation instructions provided with the ceiling damper.

10. **Wire Mesh** — (Not Shown) — For use with Item 5A and 5B — 1 in. 20 gauge galvanized poultry netting installed between the furring channels and gypsum board. The poultry netting is attached with washers and 1/2 in. wafer head screws, spaced 24 in. OC., to the furring channels. The **Fiber, Sprayed** (Item 5A or 5B) is installed through cut-openings in the poultry netting, in-between trusses. The cut-openings in the poultry netting shall be staggered at a maximum of 6 ft.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

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BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

[See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances](#)

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Design No. P522

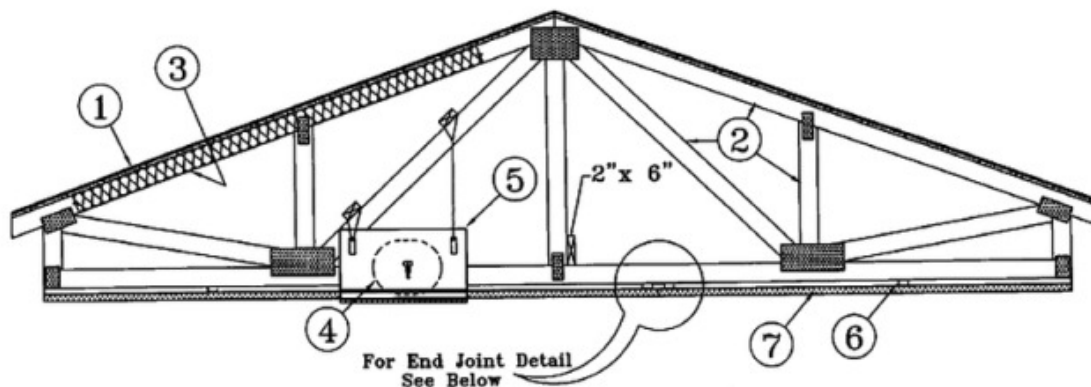
April 05, 2018

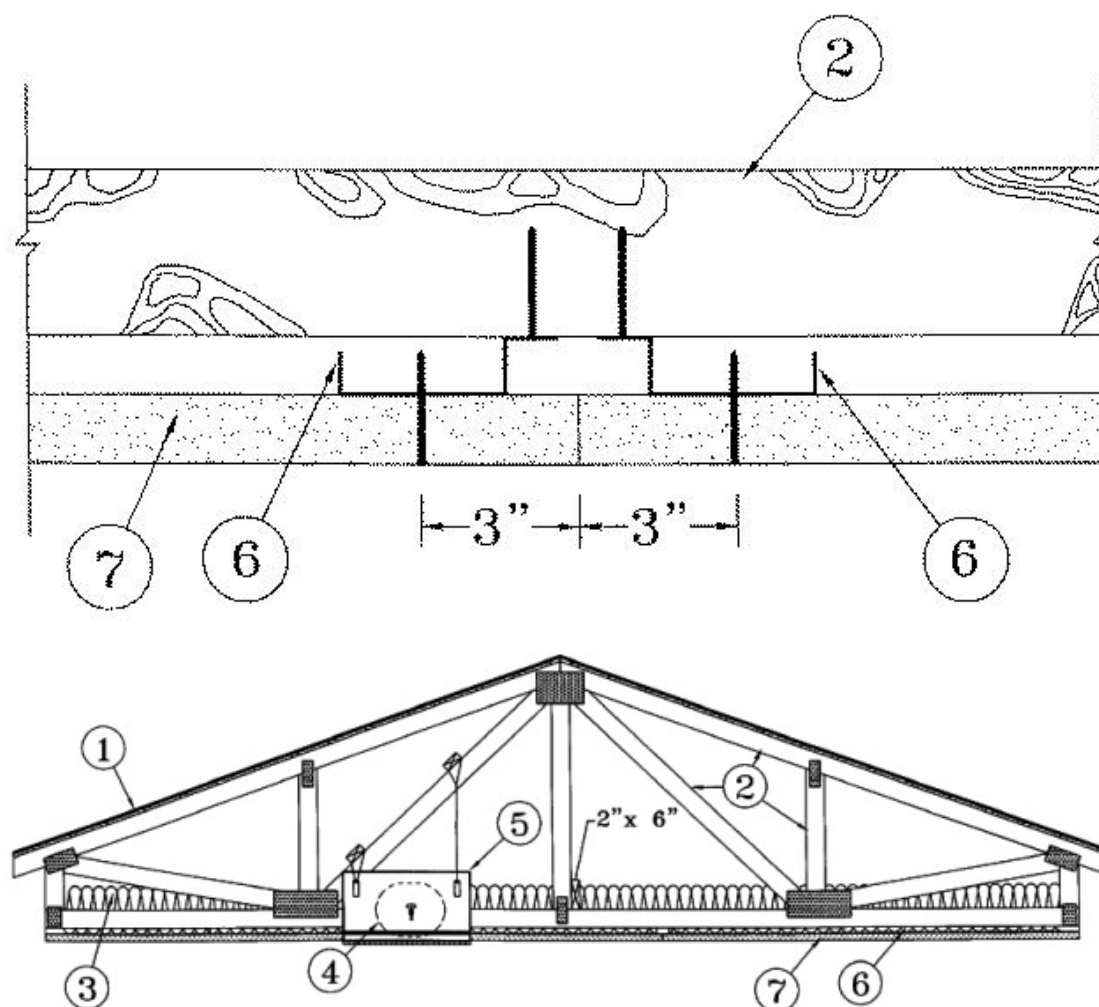
Unrestrained Assembly Rating — 1 Hr

Finish Rating — 25 Min (See Items 3 or 3A)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide [BXUV](#) or [BXUV7](#)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**





Alternate Insulation Placement

1. **Roofing System*** — Any UL Class A, B or C Roofing System (TGFU) or Prepared Roof Covering (TFWZ) acceptable for use over nom 15/32 in. thick wood structural panels, min. grade "C-D" or "Sheathing". Nom 15/32 in. thick wood structural panels secured to trusses with No. 6d ringed shank nails spaced 12 in. OC along each truss. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Construction adhesive may be used with either the nails or staples.

2. **Trusses** — Pitched or parallel chord wood trusses, spaced a max of 24 in. OC, fabricated from nom 2 by 4 lumber, with lumber oriented vertically or horizontally. Truss members secured together with min. 0.0356 in. thick galv steel plates. Plates have 5/16 in. long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split tooth type plate. Each tooth has a chisel point on its outside edge. These points are diagonally opposite each other for each pair. The top half of each tooth has a twist for stiffness. The pairs are repeated on approximately 7/8 in. centers with four rows of teeth per inch of plate width. Where the truss intersects with the interior face of the exterior walls, the min truss depth shall be 5-1/4 in. with a min roof slope of 3/12 and a min. area in the plane of the truss of 21 sq/ft. Where the truss intersects with the interior face of the exterior walls, the min truss depth may be reduced to 3 in. if the batts and blankets (Item 3) are used as shown in the above illustration (Alternate Insulation Placement) and are firmly packed against the intersection of the bottom chords and the plywood sheathing.

3. **Batts and Blankets*** — (Optional) — Required when Item 6B is used — Glass fiber insulation, secured to the wood structural panels with staples spaced 12 in. OC or to the trusses with 0.090 in. diam galv steel wires spaced 12 in. OC. Any glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance, having a min density of 0.5 pcf. As an option, the insulation may be fitted in the concealed space, draped over the resilient channel/gypsum board ceiling membrane when resilient channels and gypsum board attachment is modified as specified in Items 6 and 7. When **Steel Framing Members** (Item 6B) are used, max 3-1/2 in. thick insulation shall be draped over the furring channels (Item 6Ba) and gypsum board ceiling membrane, and friction-fitted between trusses and Steel Framing Members (Item 6Bd). The finished rating has only been determined when the insulation is secured to the decking.

3A. **Fiber, Sprayed*** — As an alternate to Item 3 (not evaluated for use with Item 6B) — Any thickness of spray-applied cellulose insulation material, having a min density of 0.5 lb/ft³, applied with water, over the resilient channel/gypsum board ceiling membrane when resilient channels and gypsum board attachment is modified as specified in Items 6 and 7. Fiber, Sprayed is applied with moisture in accordance with the application instructions supplied with the product. The finish rating when Fiber Sprayed is used has not been determined. Alternate application method: The fiber is applied without water or adhesive in accordance with the application instructions supplied with a minimum density of 0.5 lb/ft³ over the resilient channel/gypsum board ceiling membrane when resilient channels and gypsum board attachment is modified as specified in Items 6 and 7. Alternate application method: The fiber is applied without water or adhesive to a nominal density of 3.5

lb/ft³ behind netting (Item 9) stapled to the rafters. The netting is stapled at both lower edges of the rafters creating a cavity to accept the cellulose fiber.

U S GREENFIBER L L C — INS735& INS745 for use with wet or dry application. INS510LD, INS515LD, INS541LD, INS735, INS745, INS765LD, and INS770LD are to be used for dry application only.

3B. Foamed Plastic* — (As an alternate to Item 3 or 3A, Not Shown) — Spray foam insulation applied directly to the underside of the underside of the roofing system (Item 1). Spray foam insulation installed to a maximum thickness of 10 in. at a nominal 0.5 lb/ft³ density. When spray foam insulation is used, resilient channels (Item 6) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 7) installed at 6 in. OC to allow for maximum 3 in. spacing off ends of the gypsum board joints. Gypsum board (Item 7) to be installed using 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a fire damper (Items 5 through 5H) in the concealed space, minimum 1 in. clearance to be maintained between damper housing and spray foam insulation. Not evaluated for use with Items 6A through 6F.

SES FOAM INC — Sucraseal 0.5 lb

3C. Cavity Insulation - Batts and Blankets* or Fiber, Sprayed* — (As described above) in Items 3 and 3A — (For Use with Item 7B, Not Shown) — Min. 3-1/2 in thick with no limit on maximum thickness fitted in the concealed space, draped over the resilient channel (Item 6G)/gypsum board (Item 7B) ceiling membrane.

3D. Foamed Plastic* — (As alternate to Item 3, 3A, or 3B, Not Shown) — Spray foam insulation applied directly to the underside of the roofing system (Item 1). Spray foam insulation installed to a maximum thickness of 10 in. at a nominal 0.5 lb/ft³ or 2.0 lb/ft³ density, depending on the product installed. When spray foam insulation is installed, resilient channels (Item 6) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 7) spaced maximum 3 in. away from gypsum butt joints. Gypsum board (Item 7) to be installed using minimum 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a fire damper (Items 5 through 5H) in the concealed space, minimum 1 in. clearance to be maintained between damper housing and spray foam insulation. Not evaluated for use with Items 6A through 6F.

BASF CORP — Enertite® NM, Enertite® G, FE178®, Spraytite® 178, Spraytite® 81206, Walltite® 200, Walltite® US, Walltite® US-N, and Walltite® HP+

4. Air Duct* — Any UL Class 0 or Class 1 flexible air duct installed in accordance with the instructions provided by the damper manufacturer.

5. Ceiling Damper* — Max nom area, 324 sq in. Max square size, 18 in. by 18 in. rectangular sizes not to exceed 324 sq in. with a max width of 18 in. Max damper height is 14 in. Installed in accordance with manufacturers installation instructions provided with the damper. Max damper openings not to exceed 162 sq in. per 100 sq ft of ceiling area.

C&S AIR PRODUCTS — Model RD-521

POTTORFF — Model CFD-521

5A. Alternate Ceiling Damper* — Max nom area, 196 sq in. Max square size, 14 in. by 14 in. Rectangular sizes not to exceed 196 sq in. with a max width of 26 in. Max overall damper height is 7 in. Installed in accordance with the manufacturers installation instructions provided with the damper. Max damper openings not to exceed 98 sq in. per 100 sq ft of ceiling area.

C&S AIR PRODUCTS — Model RD-521-BT

POTTORFF — Model CFD-521-BT.

5B. Alternate Ceiling Damper* — Max nom area shall be 256 sq in. with the length not to exceed 24 in. and the width not to exceed 20 in. Max height of damper shall be 17 in. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille shall be installed in accordance with installation instructions.

POTTORFF — Models CFD-521-IP, CFD-521-NP

5C. Alternate Ceiling Damper* — Ceiling damper & fan assembly. Max nom area shall be 75 sq in. with the length not to exceed 8-9/16 in. and the width not to exceed 8-3/4 in. Max height of damper shall be 9-7/8 in. Aggregate damper openings shall not exceed 38 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturers installation instructions provided with the damper. A plastic grille shall be installed in accordance with installation instructions.

DELTA ELECTRONICS INC — Models CRD2, GBR-CRD, ITG-CRD

5D. Alternate Ceiling Damper* — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 75 sq in. with the length not to exceed 9-1/4 in. and the width not to exceed 9-3/4 in. Max height of damper shall be 9-7/8 in. Aggregate damper openings shall not exceed 45 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille shall be installed in accordance with installation instructions.

DELTA ELECTRONICS INC — Model SIG-CRD

5E. Alternate Ceiling Damper* — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 131 sq in. with the length not to exceed 11-1/16 in. and the width not to exceed 11-7/8 in. Aggregate damper openings shall not exceed 66 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille shall be installed in accordance with installation instructions.

DELTA ELECTRONICS INC — Model SMT-CRD

5F. Alternate Ceiling Damper* — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 103 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 10-1/8 in. Aggregate damper openings shall not exceed 52 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille shall be installed in accordance with installation instructions.

PANASONIC CORPORATION, PANASONIC CORPORATION OF NORTH AMERICA — Model PC-RD05C5

5G. Alternate Ceiling Damper* — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 113 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 11-1/8 in. Aggregate damper openings shall not exceed 57 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDFUWT

5H. Alternate Ceiling Damper* — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 79 sq in. with the length not to exceed 10 in. and the width not to exceed 7-15/16 in. Aggregate damper openings shall not exceed 40 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A metallic grille shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Models RDJ1 and RDH

5I. Alternate Ceiling Damper* — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 87 sq in. with the length not to exceed 9 in. and the width not to exceed 9-11/16 in. Aggregate damper openings shall not exceed 44 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDMWT

6. Furring Channels — Resilient channels formed of 25 MSG thick galv steel. Installed perpendicular to the trusses (Item 2), spaced a max of 16 in. OC when no insulation (Item 3 or 3A) is fitted in the concealed space, or a max of 12 in. OC when insulation (Item 3 or 3A) is fitted in the concealed space, draped over the resilient channel/gypsum board ceiling membrane, or when insulation (Item 3B or 3D) is applied to the underside of the roofing system (Item 1). Two courses of resilient channel positioned 6 in. OC at wallboard butt-joints (3 in. from each end of wallboard). Channels oriented opposite at wallboard butt-joints. Channel splices overlapped 4 in. beneath wood trusses. Channels secured to each truss with 1-1/4 in. long Type S screws.

6A. Steel Framing Members* — (Not Shown) — As an alternate to Item 6, furring channels and Steel Framing Members as described below:

a. Furring Channels — Formed of No. 25 MSG galv steel. 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to trusses when no insulation (Items 3 or 3A) is fitted in the concealed space or 12 in. OC when insulation (Items 3 or 3A) is fitted in the concealed space, draped over the furring channel/gypsum board ceiling membrane or 24 in. OC when insulation (Items 3 or 3A) is fitted in the concealed space, draped over the furring channel/gypsum board ceiling membrane and a second layer of gypsum board is attached as described in Item 7 for steel framing members. Channels secured to trusses as described in Item 6Ab. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. Steel Framing Members — Used to attach furring channels (Item a) to trusses (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to alternating trusses with No. 8 by 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to alternating trusses with No. 8 by 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item 6Aa. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws,

min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 7.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75).

6B. Steel Framing Members* — (Not Shown) — As an alternate to Items 6 and 6A.

a. **Furring Channels** — Hat-shaped furring channels, 7/8 in. deep by 2-5/8 in. wide at the base and 1-1/4 in. wide at the face, formed from No. 25 ga. galv steel, spaced max 16 in. OC perpendicular to trusses and Cold Rolled Channels (Item 6Bb). Furring channels secured to Cold Rolled Channels at every intersection with a 1/2 in. pan head self-drilling screw through each furring channel leg. Ends of adjoining channels overlapped 4 in. and tied together with two double strand No. 18 SWG galv steel wire ties, one at each end of overlap. Supplemental furring channels at base layer and outer layer gypsum board butt joints are not required. Batts and Blankets draped over furring channels as described in Item 3. Two layers of gypsum board attached to furring channels as described in Item 7.

b. **Cold Rolled Channels** — 1-1/2 in. by 1/2 in., formed from No. 16 ga. galv steel, positioned vertically and parallel to trusses, friction-fitted into the channel caddy on the Steel Framing Members (Item 6Bd). Adjoining lengths of cold rolled channels lapped min. 6 in. and wire-tied together with two double strand 18 SWG galv steel wire ties, one at each end of overlap.

c. **Blocking** — Where truss design does not permit direct, full contact of the hanger bracket, a piece of nominal 2 by 4 in. lumber (blocking), min. 6 in. long to permit full contact of the hanger bracket, to be secured vertically to the side of the truss (Item 2) at the top and bottom of the blocking at each Steel Framing Member (Item 6Bd) location.

d. **Steel Framing Members*** — Hangers spaced 48 in. OC. max along truss, and secured to the Blocking (Item 6Bc) on alternating trusses with a single 5/16 in. by 2 in. hex head lag bolt or four #6 1-1/4 in. drywall screws through mounting hole(s) on the hanger bracket. The two 1/4 in. long steel teeth on the hanger are embedded in the side of the blocking. Hanger positioned on blocking and leveling bolt height adjusted such that furring channels are flush with bottom of trusses before gypsum board installation. Spring gauge of hanger chosen per manufacturer's instructions.

KINETICS NOISE CONTROL INC — Type ICW.

6C. Steel Framing Members* — (Not Shown) — As an alternate to Items 6, 6A and 6B.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep installed perpendicular to wood structural members. Channels spaced a max of 24 in. OC when no insulation (Item 3 or 3A) is fitted in the concealed space or a max of 12 in. OC when insulation (Item 3 or 3A) is fitted in the concealed space. Channels secured to trusses as described in Item 6Cb. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Ca) to trusses (Item 2). Clips secured to the bottom chord of each truss (24 in. OC) with one No. 8 by 2-1/2 in. long coarse drywall screw through center grommet. Furring channels are friction fitted into clips. Adjoining channels are overlapped as described in Item 6Ca. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 7.

PLITEQ INC — Type Genie Clip

6D. Steel Framing Members* — (Not Shown) — As an alternate to Items 6, 6A, 6B and 6C.

a. **Main runners** — Installed perpendicular to trusses — Nom 10 or 12 ft long, 15/16 in. or 1-1/2 in. wide face, spaced 4 ft OC. Main runners hung a min of 2 in. from bottom chord of trusses with 12 SWG galv steel wire. Wires located a max of 48 in. OC.

b. **Cross tees or channels** — Nom 4 ft long, 15/16 in. or 1-1/2 in. wide face or cross channels, nom 4 ft long, 1-1/2 wide face, installed perpendicular to the main runners, spaced 16 in. OC. Additional cross tees or channels used at 8 in. from each side of butted gypsum board end joints. The cross tees or channels may be riveted or screw-attached to the wall angle or channel to facilitate the ceiling installation.

c. **Wall angles or channels** — Used to support steel framing member ends and for screw-attachment of the gypsum wallboard — Min 0.016 in. thick painted or galvanized steel angle with 1 in. legs or min. 0.016 in. thick painted or galvanized steel channel with a 1 by 1-1/2 by 1 in. profile, attached to walls at perimeter of ceiling with fasteners 16 in. OC.

CGC INC — Type DGL or RX

USG INTERIORS LLC — Type DGL or RX

6E. Alternate Steel Framing Members* — (Not Shown) — As an alternate to items 6, 6A, 6B, and 6C, furring channels and Steel Framing Members as described below.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-5/8 in. wide by 7/8 in deep, spaced 24 in OC, perpendicular to trusses. When insulation, Items 3 or 3A is used, the furring channel spacing shall be reduced to 12 in. OC. Channels secured to joists as described in Item b.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to the wood trusses (Item 2). Clips spaced at 48" OC and secured to the bottom of the trusses with one 2 in. Coarse Drywall Screw with 1 in. diam washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6" and tied together with double strand of No. 18 AWG galvanized steel wire. Additional clips are required to hold the Gypsum Butt joints as described in Item 7.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237 or A237R

6F. **Steel Framing Members*** — (Not Shown) — As an alternate to Items 6 through 6E- Not for use with Items 3 or 3A. Main runners nom 12 ft long, spaced 72 in. OC. Main runners suspended by min 12 SWG galv steel hanger wires spaced 48 in. OC. Cross tees, nom 6 ft long, installed perpendicular to main runners and spaced 24 in. OC. Additional 6 ft long cross tees required at each gypsum board end joint with butted gypsum board end joints centered between cross tees spaced 8 in. OC. The main runners and cross tees may be riveted or screw attached to the wall angle or channel to facilitate the ceiling installation.

USG INTERIORS LLC — Type DGL or RX

6G. **Resilient Channels** — For Use With Item 7B - Formed from min 25 MSG galv steel installed perpendicular to trusses and spaced 16 in. OC. Channels secured to each truss with 1-5/8 in. long Type S bugle head steel screws. Channels overlapped 4 in. at splices. Two channels, spaced 6 in. OC, oriented opposite each gypsum panel end joint. Additional channels shall extend min 6 in. beyond each side edge of panel. Insulation, Item 3C is applied over the resilient channel/gypsum panel ceiling membrane.

7. **Gypsum Board*** — One layer of nom 5/8 in. thick by 48 in. wide boards, installed with long dimension parallel to trusses. Attached to the resilient channels using 1 in. long Type S bugle-head screws. Screws spaced a max of 12 in. OC along butted end-joints and in the field when no insulation (Item 3 or 3A) is fitted in the concealed space, or a max of 8 in. OC along butted end-joints and in the field when insulation (Item 3 or 3A) is fitted in the concealed space, draped over the resilient channel/gypsum board ceiling membrane. When insulation (Item 3B or 3D) is installed in the concealed space, spray-applied to the underside of the roofing system (Item 1), screws are spaced a max of 8 in. OC along resilient channels, fasteners are increased in length to 1-1/4 in. and gypsum board butt joints shall be staggered min. 2 ft within the assembly, and occur between the main furring channels.

When **Steel Framing Members*** (Item 6A or 6C) are used, sheets installed with long dimension perpendicular to furring channels and side joints of sheet located beneath trusses. Gypsum board screws are driven through channel spaced 12 in. OC in the field when no insulation (Item 3 or 3A) is fitted in the concealed space, or 8 in. OC in the field when insulation (Item 3 or 3A) is fitted in the concealed space, draped over the furring channel/gypsum board ceiling membrane. Gypsum board butt joints shall be staggered min. 2 ft within the assembly, and occur between the main furring channels. At the gypsum board butt joints, each end of the gypsum board shall be supported by a single length of furring channel equal to the width of the wallboard plus 6 in. on each end. The furring channels shall be spaced approximately 3-1/2 in. OC, and be attached to the trusses with one clip at each end of the channel. Screw spacing along the butt joint to attach the gypsum board to the furring channels shall be 8 in. OC. Second (outer) layer of gypsum board required when furring channels (Item 6A, a) are spaced 24 in. OC and insulation is fitted in the concealed space, draped over the furring channel/gypsum board ceiling membrane. Outer layer of gypsum board attached to the furring channels using 1-5/8 in. long Type S bugle-head screws spaced 8 in. OC at butted joints and 12 in. OC in the field. Butted end joints of outer layer to be offset a minimum of 8 in. from base layer end joints. Butted side joints of outer layer to be offset minimum 18 in. from butted side joints of base layer.

When **Steel Framing Members** (Item 6B) are used, two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimensions perpendicular to furring channels (Item 6Ba). Base layer attached to the furring channels using 1 in. long Type S bugle head steel screws spaced 8 in. OC along butted end joints and 12 in. OC in the field of the board. Butted end joints centered on the continuous furring channels. Butted base layer end joints to be offset a min of 16 in. in adjacent courses. Outer layer attached to the furring channels using 1-5/8 in. long Type S bugle head steel screws spaced 8 in. OC at butted end joints and 12 in. OC in the field. Butted end joints centered on the continuous furring channels and offset a min of 16 in. from butted end joints of base layer. Butted side joints of outer layer to be offset min 16 in. from butted side joints of base layer.

When **Steel Framing Members** (Item 6C) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 72 in. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 3 in. on each end, spaced approximately 2 in. in from joint. Screw spacing along the gypsum board butt joint shall be 8 in. OC. Butt joint furring channels shall be attached with a RESILMOUNT Sound Isolation Clip secured to underside of every truss that is located over the butt joint. Over all Gypsum Board side joints, approximately 20 in. lengths of furring channel shall be installed parallel to trusses (Item 2) between main furring channels. Side joint furring channels shall be attached to underside of the joist with RESILMOUNT Sound Isolation Clips - located approximately 2 in. from each end of the approximate 20 in. length of channel. Both Gypsum Boards at side joints fastened into channel with screws spaced 8 in. OC, approximately 1/2 in. from joint edge.

When **Steel Framing Members** (Item 6E) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 3 in. on each end. The two support furring channels shall be spaced approximately 3 in. in from end joint. Screw spacing along the gypsum board butt joint and along both additional channels shall be 8 in. OC. Additional screws shall be placed in the adjacent section of gypsum board into the aforementioned 3 in. extension of the extra butt joint channels as well as into the main channel that runs between. Butt joint furring channels shall be attached with one RESILMOUNT Sound Isolation Clip at each end of the channel.

When alternate **Steel Framing Members*** (Item 6F) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board sheets installed with long dimension (side joints) perpendicular to the 6 ft long cross tees with the end joints staggered min 4 ft and centered between cross tees which are spaced 8 in. OC. Gypsum board side joints may occur beneath or between main runners. Prior to installation of the gypsum board sheets, backer strips consisting of nom 7-3/4 in. wide pieces of gypsum board are to be laid atop the cross tee flanges and centered over each butted end joint location. The backer strips are to be secured to the flanges of the cross tees at opposite corners of the backer strip with hold down clips to prevent the backer strips from being uplifted during screw-attachment of the gypsum board sheets. Gypsum board fastened to cross tees with 1 in. drywall screws spaced 1 in. and 4 in. from the side joints and max 8 in. OC in the field of the board. The butted end joints are to be secured to the backer strip with No. 10 by 1-1/2 in. long Type G laminating screws located 1 in. from each side of the butted end joint and spaced 1 in. and 4 in. from the side joints and max 8 in. OC in the field of the board.

CGC INC — Types C, IP-X2, IPC-AR

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

7A. Gypsum Board* — For use with Steel Framing Members (Item 6D) when Batts and Blankets* (Item 3) are not used - One layer of nom 5/8 in. thick by 48 in. wide boards, installed with long dimension parallel to the main runners. Gypsum board fastened to each cross tee or channel with five wallboard screws, with one screw located at the midspan of the cross tee or channel, one screw located 12 in. from and on each side of the cross tee or channel mid span and one screw located 1-1/2 in. from each gypsum board side joint. Except at wallboard end joints, wallboard screws shall be located on alternating sides of cross tee flange. At gypsum board end joints, gypsum board screws shall be located 1/2 in. from the joint. Gypsum board fastened to main runners with wallboard screws 1/2 in. from side joints, midway between intersections with cross tees or channels (16 in. OC). End joints of adjacent gypsum board sheets shall be staggered not less than 32 in. Gypsum board sheets screw attached to leg of wall angle with wallboard screws spaced 12 in. OC. Joints treated as described in Item 7. For use with **Steel Framing Members*** (Item 6D) when **Batts and Blankets*** (Item 3) are used - Ratings limited to 1 Hour - 5/8 in. thick, 4 ft wide; installed with long dimension perpendicular to cross tees with side joints centered along main runners and end joints centered along cross tees. Fastened to cross tees with 1 in. long steel gypsum board screws spaced 8 in. OC in the field and 8 in. OC along end joints. Fastened to main runners with 1 in. long gypsum board screws spaced midway between cross tees. Screws along sides and ends of boards spaced 3/8 to 1/2 in. from board edge. End joints of the sheets shall be staggered with spacing between joints on adjacent boards not less than 4 ft OC.

CGC INC — Type C or IP-X2

UNITED STATES GYPSUM CO — Type C or IP-X2

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Type C or IP-X2

7B. Gypsum Board* — For use with Items 3C and 6G. Nom 5/8 in. thick, 48 in. wide gypsum panels installed with long dimension perpendicular to resilient channels. Gypsum panels secured with 1 in. long Type S bugle head steel screws spaced 8 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. Finish Rating with this ceiling system is 20 min.

UNITED STATES GYPSUM CO — Type ULIX

8. Finishing System — (Not Shown) — Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads; paper tape, 2 in. wide, embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board. **Alternate Ceiling Membrane** — Not Shown.

9. Netting — Fibrous, woven netting material fastened to underside of each joist with staples, with side joints overlapped.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2018-04-05

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Design No. U210
BXUV.U210
Fire-resistance Ratings - ANSI/UL 263

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Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
 - Authorities Having Jurisdiction should be consulted before construction.
 - Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
 - When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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BXUV - Fire Resistance Ratings - ANSI/UL 263

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

[See General Information for Fire-resistance Ratings - ANSI/UL 263](#)

[See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada](#)

Design No. U210

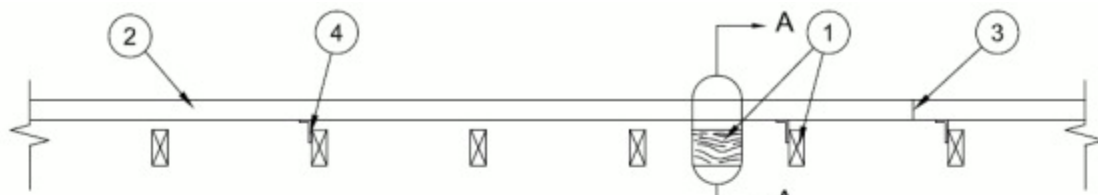
April 18, 2016

Bearing Wall Rating — 2, 3 or 4 Hr (See Items 3A, 5, 7 and 8)

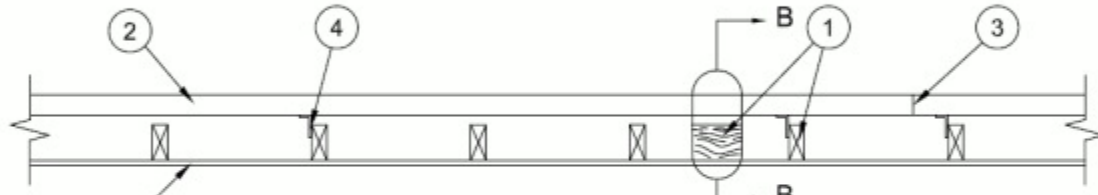
Finish Rating — See Items 3A and 9

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide [BXUV](#) or [BXUV7](#)

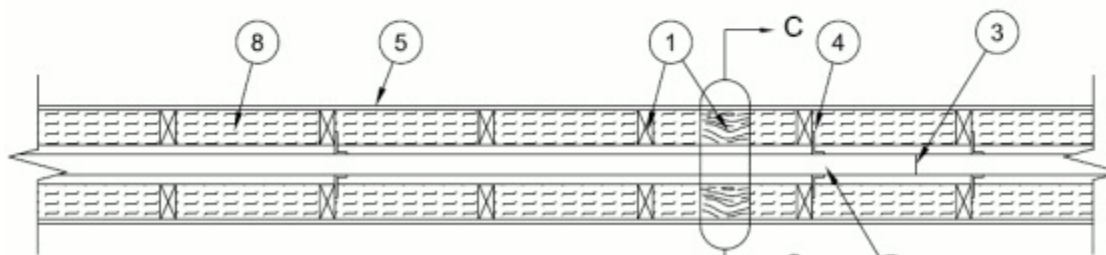
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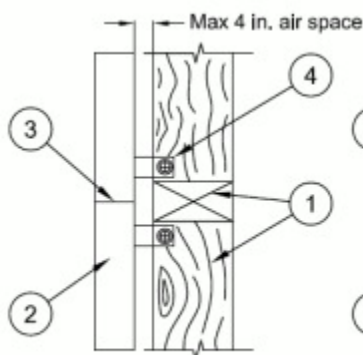
Configuration A - 2 Hr
Exposed to Fire from PAAC Panel Side Only



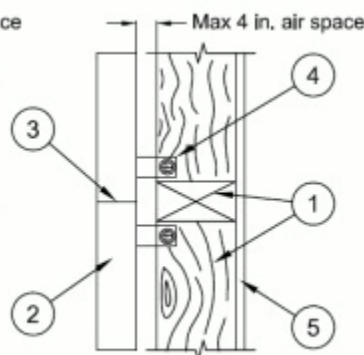
Configuration B - 3 Hr
Exposed to Fire from PAAC Panel Side Only



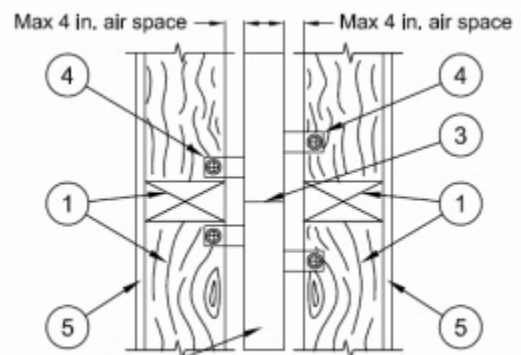
Configuration C - 4 Hr
Exposed to Fire from Either Side



Section A-A



Section B-B



Section C-C

1. **Wood Studs** — Nom 2 in. by 4 in., spaced a max of 16 in. OC. Studs to be effectively firestopped at the top and bottom of the wall with nom 2 in. by 4 in. plates. Studs effectively cross-braced.

1A. **Steel Studs** — (Not Shown - Not to be used with Item 8, Batts and Blankets) — As an alternate to Item 1 — Min 0.0329 in., bare metal thickness (No. 20 MSG) corrosion-protected steel studs, min 3-1/2 in. wide, cold formed, designed in accordance with the current edition of the Specification for the Design of Cold-Formed Steel Structural Members by the American Iron and Steel Institute (AISI). All design details enhancing the structural integrity of the wall assembly, including the axial design load of the studs, shall be as specified by the steel stud designer and/or producer, and shall meet the requirements of all applicable local code agencies. The max stud spacing shall not exceed 16 in. OC. Studs attached to floor and ceiling runners (Item 1B) with 1/2 in. long Type S-12 steel screws on both sides of the studs or by welded or bolted connections designed in accordance with the AISI specifications.

1B. **Floor and Ceiling Runners** — (Not Shown) — For use with Item 1A. Channel shaped, fabricated from min 0.0329 in., bare metal thickness (No. 20 MSG) corrosion-protected steel, that provide a sound structural connection between steel studs and adjacent assemblies such as floors, ceilings and/or other walls. Attached to floor and ceiling assemblies with steel fasteners spaced not greater than 24 in. OC.

2. **Precast Autoclaved Aerated Concrete Panels*** — 2 in. thick, max 24 in. wide and 8 ft or 10 ft long panels installed horizontally or vertically. Panels secured to studs with attachment clips (Item 4). Vertical and horizontal joints need not be backed by nor centered over studs. Butt joints staggered min. 16 in. from adjacent panels.

THERMACRETE L L C

3. **Thin Bed Mortar** — Applied to the horizontal and vertical joints of each precast autoclaved aerated concrete panel.

3A. Fill, Void or Cavity Material* — Intumescent Strip — As an alternate to the thin bed mortar (Item 3) for Configuration B or C only, nom 1/16 in. thick by 1/2 in. wide self adhesive intumescent material strips may be used in the horizontal and vertical joints of the precast autoclaved aerated concrete panels. Lengths of intumescent strip centered on the panel's thickness along each joint. Adjoining lengths of intumescent material to be butted. **When alternate joint treatment material is used, The Assembly Rating is 2 hr and the Finish Rating is 94 min.**

3M COMPANY — E-FIS Seal

4. Attachment Clips — Aluminum angles 0.048 in. to 0.060 in. thick and 2 in. wide with one 2 in. leg and one 2-1/2 in. to 5-1/2 in. leg. A 0.704 in. outside diameter and 0.375 in. inside diameter rubber grommet is pre-attached in the 2-1/2 in. to 5-1/2 in. long leg of the angle. Clips positioned with 2 in. leg on panel side and 2-1/2 in. to 5-1/2 in. leg on stud side. Clips attached to studs (Item 1 or 1A) with one 1-5/8 in. long screw through a 3/4 in. diameter washer and the rubber grommet. Clips attached to panel (Item 2) with two 1-5/8 in. long sharp point high-low thread screws spaced 3/4 in. OC at pre-drilled holes. Max. 4 in. airspace between edge of stud and panel. Panel screws angled 20 degrees from the horizontal as shown. When panels are installed vertically, clips spaced max 16 in. from horizontal joints and max 4 ft OC vertically per panel. When panels are installed horizontally, clips spaced max 16 in. from vertical joints and max 4 ft OC horizontally per panel. Minimum of three clips per 8 ft long side of panel. Minimum of three clips per 10 ft long side of panel. Configuration C - Clips staggered on opposite sides of panel to permit attachment to studs and panels.

5. Gypsum Board — Any 5/8 in. thick UL Classified Gypsum Board that is eligible for use in Design Nos. L501, G512 or U305.

Configuration A

(Optional — Not Shown) — Gypsum Board - Classified or Unclassified - One layer of min 1/2 in. thick by 48 in. wide boards installed horizontally or vertically to wood studs or steel studs. Gypsum board attached to wood studs using 1-5/8 in. wallboard screws spaced 8 in. OC along the edges and in the field. Gypsum board attached to steel studs using 1 in. long Type S-12 steel screws spaced 8 in. OC along the edges and in the field.

Configuration B

(Required) — Gypsum Board - Classified or Unclassified - One layer of min 1/2 in. thick by 48 in. wide boards installed horizontally or vertically to wood studs or steel studs. Gypsum board attached to wood studs using 1-5/8 in. wallboard screws spaced 8 in. OC along the edges and in the field. Gypsum board attached to steel studs using 1 in. long Type S-12 steel screws spaced 8 in. OC along the edges and in the field.

Configuration C

(Required) — **Gypsum Board* - Any 5/8 in. thick UL Classified Gypsum Board that is eligible for use in Design Nos. L501, G512 or U305.** One layer of min 5/8 in. thick by 48 in. wide boards installed horizontally or vertically to wood studs. Gypsum board attached to wood studs using 1-5/8 in. wallboard screws spaced 8 in. OC along the edges and in the field.

ACADIA DRYWALL SUPPLIES LTD ([View Classification](#)) — CKNX.R25370

AMERICAN GYPSUM CO ([View Classification](#)) — CKNX.R14196

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO ([View Classification](#)) — CKNX.R19374

CERTAINTED GYPSUM INC ([View Classification](#)) — CKNX.R3660

CGC INC ([View Classification](#)) — CKNX.R19751

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C ([View Classification](#)) — CKNX.R18482

GEORGIA-PACIFIC GYPSUM L L C ([View Classification](#)) — CKNX.R2717

LOADMASTER SYSTEMS INC ([View Classification](#)) — CKNX.R11809

NATIONAL GYPSUM CO ([View Classification](#)) — CKNX.R3501

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM ([View Classification](#)) — CKNX.R7094

PANEL REY S A ([View Classification](#)) — CKNX.R21796

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD ([View Classification](#)) — CKNX.R19262

THAI GYPSUM PRODUCTS PCL ([View Classification](#)) — CKNX.R27517

UNITED STATES GYPSUM CO ([View Classification](#)) — CKNX.R1319

USG MEXICO S A DE C V ([View Classification](#)) — CKNX.R16089

6. **Thin Bed Mortar or Repair Mortar** — Applied to surface cracks on both sides of precast autoclaved aerated concrete panel per manufacturer's specifications.

7. **Finishing System** —

Configuration A

(Not Shown) — Gypsum board joints optionally covered with paper tape and joint compound. Nail heads optionally covered with joint compound.

Configurations B and C

(Not Shown) — Gypsum board joints to be covered with paper tape and joint compound. Nail heads optionally covered with joint compound.

8. **Batts and Blankets*** —

Configurations A and B

(Optional — Not Shown — Not to be used with Item 1A) — Placed to completely or partially fill the stud cavities, any glass fiber or mineral wool insulation, max 3.0 pcf density, bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance. See **Batts and Blankets** (BKNV or BZJZ) Categories for names of Classified companies.

Configuration C

(Required — Not to be used with Item 1A) — Placed to completely fill the stud cavities in both rows of studs, any glass fiber or mineral wool insulation, max 3.0 pcf density, bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance. See **Batts and Blankets** (BKNV or BZJZ) Categories for names of Classified companies.

9. **Finish Rating** —

Configurations A and B

Finish rating is 142 minutes when airspace is 0 in., with or without Batts and Blankets*. Finish rating is 147 minutes when Batts and Blankets* are used and airspace is 1 to 4 in. Finish rating is 155 minutes when **Batts and Blankets*** are not used and airspace is 1 to 4 in.

Configuration C

Finish rating is 25 minutes without Batts and Blankets. Finish rating has not been determined when Batts and Blankets are used.

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Design No. U301 BXUV.U301 Fire-resistance Ratings - ANSI/UL 263

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BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

[See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States Design Criteria and Allowable Variances](#)

[See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada Design Criteria and Allowable Variances](#)

Design No. U301

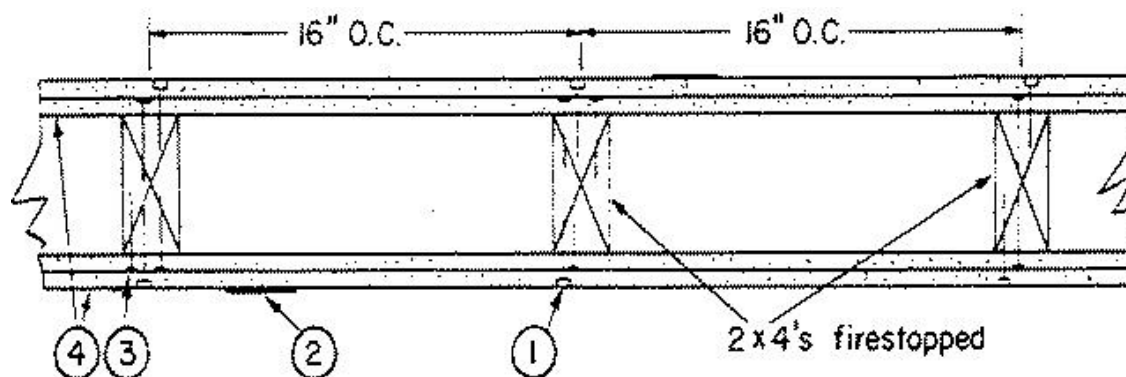
July 11, 2018

Bearing Wall Rating — 2 Hr.

Finish Rating — 66 Min.

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide **BXUV** or **BXUV7**

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



1. Nailheads — Exposed or covered with joint compound.

2. **Joints** — Exposed joints covered with joint compound and paper tape. Joint compound and paper tape may be omitted when square edge boards are used. As an alternate, nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard with the joints reinforced with paper tape.

3. **Nails** — 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam, 1/4 in. diam heads, and 8d cement coated nails 2-3/8 in. long, 0.113 in. shank diam, 9/32 in. diam heads.

4. **Gypsum Board*** — 5/8 in. thick, two layers applied either horizontally or vertically. Inner layer attached to studs with the 1-7/8 in. nails spaced 6 in. OC. Outer layer attached to studs over inner layer with the 2-3/8 in. long nails spaced 8 in. OC. Vertical joints located over studs. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side.

When used in widths other than 48 in., gypsum board to be installed horizontally.

When **Steel Framing Members*** (Item 6, 6A, 6B, or 6C) are used, base layer attached to furring channels with 1 in. long Type S bugle-head steel screws spaced max 24 in. OC; face layer attached with 1-5/8 in. long Type S bugle-head steel screws spaced max 12 in. OC.

ACADIA DRYWALL SUPPLIES LTD — Type X, 5/8 Type X, Moisture Resistant Type X, Gypsum Sheathing Type X, Mold & Mildew Resistant Type X and Mold & Mildew Resistant AR Type X, Type Blueglass Exterior Sheathing

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, AGX-11, LightRoc

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1

CERTAINTED GYPSUM INC — Types 1, FRPC, EGRG, GlasRoc, GlasRoc-2, Type C, Type X, Type X-1

CGC INC — Types AR, C, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULX, USGX, WRC, WRX

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Types LGFC2A, LGFC6A, LGFC-C/A, LGFC-WD, LGLLX

GEORGIA-PACIFIC GYPSUM L L C — Types 5, 6, 9, C, DAP, DD, DA, DAPC, DGG, DS, GPFS6. LS, TG-C, Type X, Veneer Plaster Base-Type X, Water Rated-Type X, Sheathing Type-X, Soffit-Type X, GreenGlass Type X, Type LWX, Veneer Plaster Base-Type LWX, Water Rated-Type LWX, Sheathing Type-LWX, Soffit-Type LWX, Type DGLW, Water Rated-Type DGLW, Sheathing Type- DGLW, Soffit-Type DGLW, Type LW2X, Veneer Plaster Base - Type LW2X, Water Rated - Type LW2X, Sheathing - Type LW2X, Soffit - Type LW2X, Type DGL2W, Water Rated - Type DGL2W, Sheathing - Type DGL2W

NATIONAL GYPSUM CO — Types eXP-C, FSK, FSK-C, FSK-G, FSW, FSW-3, FSW-5, FSW-6, FSW-8, FSW-C, FSW-G, FSMR-C, FSL

NATIONAL GYPSUM CO — Riyadh, Saudi Arabia — Type FR, or WR.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types C, PG-2, PG-3, PG-3W, PG-4, PG-5, PG-5W, PG-5WS, PG-9, PG-11, PG-C or PGS-WRS

PANEL REY S A — Types PRC, PRC2, PRX, RHX, MDX, ETX, GREX

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1

THAI GYPSUM PRODUCTS PCL — Type C or Type X

UNITED STATES GYPSUM CO — Types AR, C, FRX-G, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULIX, ULX, USGX, WRC, WRX

USG BORAL DRYWALL SFZ LLC — Types C, SCX, USGX

USG MEXICO S A DE C V — Types AR, C, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULX, USGX, WRC, WRX

4A. **Gypsum Board*** — (As an alternate to Item 4) — Nom 3/4 in. thick, installed as described in Item 4.

CGC INC — Types AR, IP-AR

UNITED STATES GYPSUM CO — Types AR, IP-AR

USG MEXICO S A DE C V — Types AR, IP-AR

4B. **Gypsum Board*** — (As an alternate to Items 4 and 4A) — 5/8 in. thick, 2 ft wide, tongue and groove edge, applied horizontally as the outer layer to one side of the assembly. Secured as described in Item 4. Joint covering (Item 2) not required.

CGC INC — Type SHX

UNITED STATES GYPSUM CO — Type SHX

USG MEXICO S A DE C V — Type SHX

4C. **Gypsum Board*** — (As an alternate to Items 4, 4A or 4B — Not Shown) — For Direct Application to Studs Only- For use on one or both sides of the wall as the base layer or one or both sides of the wall as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 1-1/2 in. wide, max 10 ft long with a max thickness of 0.125 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-12 pan head steel screws, F4j, one at the top of the strip and one at the bottom of the strip. Lead discs or tabs may be used in lieu of or in addition to the lead batten strips or optional at other locations. Max 3/4 in. diam by max 0.125 in. thick lead discs compression fitted or adhered over steel screw heads or max 1/2 in. by 1-1/4 in. by max 0.125 in. thick lead tabs placed on gypsum boards underneath screw locations prior to the installation of the screws. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

RAY-BAR ENGINEERING CORP — Type RB-LBG.

4D. **Gypsum Board*** — As an Alternate to Item 4 — 5/8 in. thick applied either horizontally or vertically. Inner layers fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board. Outer layers fastened to framing with 1-7/8 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board. When used in widths other than 48 in., gypsum board to be installed horizontally. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, LightRoc

4E. **Gypsum Board*** — (As an alternate to Items 4 through 4D) — 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically and secured as described in Item 4.

GEORGIA-PACIFIC GYPSUM L L C — Type X ComfortGuard Sound Deadening Gypsum Board

4F. **Gypsum Board*** — (As an alternate to Item 4) — Not to be used with item 6, 6A, 6B or 6C. 5/8 in. thick, 4 ft. wide, paper surfaced, applied vertically and secured as described in Item 4.

NATIONAL GYPSUM CO — SoundBreak XP Type X Gypsum Board

4G. **Gypsum Board *** — (As an alternate to Items 4 through 4F) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 4.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types QuietRock ES

4H. **Gypsum Board*** — (As an alternate to Item 4) — Not to be used with item 6, 6A, 6B, or 6C. 5/8 in. thick, 4 ft. wide, paper surfaced, applied vertically or horizontally and secured as described in Item 4.

CERTAINTED GYPSUM INC — Type SilentFX

4I. **Gypsum Board*** — (As an alternate to item 4) — 5/8 in. thick, two layers applied either horizontally or vertically. Inner layer attached to studs with 1-1/4 in. long Type W steel screws spaced 8 in. OC. Outer layer attached to studs over inner layer with 2 in. long Type W steel screws spaced 8 in. OC offset 6 in. from base layer. Vertical joints located over studs. Vertical and horizontal joints between inner and outer layers staggered. Outer layer joints covered with joint tape and compound, screwheads covered with joint compound. As an alternate to the joint compound nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard. Joints reinforced. Wallboard other than 48 in. wide must be applied horizontally. The SoundBreak XP Type X Gypsum Board is not to be used with Item 6, 6A, 6B, or 6C.

NATIONAL GYPSUM CO — Types eXP-C, FSK, FSK-C, FSK-G, FSW, FSW-3, FSW-5, FSW-6, FSW-C, FSW-G, FSMR-C, SoundBreak XP Type X Gypsum Board

4J. **Gypsum Board*** — (As an alternate to Items 4) — For Direct Application to Studs Only- For use as the base layer or as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 10 ft long with a max thickness of 0.140 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, max 5/16 in. diam by max 0.140 in. thick. compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.5% meeting the Federal specification QQ-L-201f, Grades "B, C or D". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

MAYCO INDUSTRIES INC — "X-Ray Shielded Gypsum"

4K. **Gypsum Board*** — For use with Item 7 — 5/8 in. thick, two layers applied vertically. Inner layer attached to resilient channels with 1 in. long steel screws spaced 8 in. OC. Outer layer attached to resilient channels over inner layer with 1-5/8 in. long steel screws spaced 8 in. OC. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side. Insulation, Items 8 or 9 is required.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, AGX-11

4L. **Gypsum Board*** — (As an alternate to Items 4) — For Direct Application to Studs Only- For use as the base layer or as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 8 ft long with a max thickness of 0.14 in. placed on the face of studs and attached to the stud with construction adhesive and two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, nominal 3/8 in. diam by max 0.085 in. thick. compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

RADIATION PROTECTION PRODUCTS INC — Type RPP - Lead Lined Drywall

4M. **Gypsum Board*** — (As an alternate to Item 4) — 5/8 in. thick, 4 ft. wide, two layers applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Secured as described in Item 4.

CERTAINTED GYPSUM INC — 5/8" Easi-Lite Type X

4N. **Gypsum Board*** — (As an alternate to 5/8 in. Type FSW in Items 4 or 4I) — Nom. 5/16 in. thick gypsum panels applied vertically or horizontally. Two layers of 5/16 in. for every single layer of 5/8 in. gypsum board described in Item 4 or 4I. Horizontal joints on the same side need not be staggered. Inner layer of each double 5/16 in. layer attached with fasteners, as described in item 4 or 4I, spaced 24 in. OC. Outer layer of each double 5/16 in. layer attached per Item 4 or 4I.

NATIONAL GYPSUM CO — Type FSW

4O. **Wall and Partition Facings and Accessories*** — (As an alternate to Items 4 through 4N) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 4.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527

4P. **Gypsum Board*** — (As an alternate to Item 4) — 5/8 in. thick, two layers applied either horizontally or vertically. Inner layer attached to studs with 1-1/4 in. long Type W steel screws spaced 10 in. OC with the last two screws 4 and 1 in. from the edges of the board. Outer layer attached to studs over inner layer with 1-7/8 in. long Type W steel screws spaced 10 in. OC offset 5 in. from base layer with the last two screws 4 and 1 in. from the edges of the board. Vertical joints

located over studs. Vertical and horizontal joints between inner and outer layers staggered. Outer layer joints covered with joint tape and compound, screwheads covered with joint compound. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC6A, Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX

4Q. Gypsum Board* — (As an alternate to Item 4. For use with Item 13) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board UL Classified for Fire Resistance (CKNX) eligible for use in Design Nos. U305 and L501 or G512. Two layers, applied either horizontally or vertically, and screwed to studs with 1-5/8 in. long Type W coarse thread steel screws at 8 in. OC at perimeter and in the field with the last two screws 4 and 3/4 in. from the edges of the board when applied as the base layer. For the face layer, screw length to be increased to 2-1/2 in. All joints in face layers staggered with joints in base layers. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

5. Molded Plastic* — Not Shown, Optional — Solid vinyl siding mechanically secured over the outer layer to framing members in accordance with manufacturer's recommended installation details.

ALSIDE, DIV OF ASSOCIATED MATERIALS INC

GENTEK BUILDING PRODUCTS LTD

VYTEC CORP

6. Steel Framing Members* — (Optional, Not Shown) — Furring channels and Steel Framing Members as described below:

A. Furring Channels — Formed of No. 25 MSG galv steel. 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Wallboard attached to furring channels as described in Item 4.

B. Steel Framing Members* — Used to attach furring channels (Item 6a) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. Furring channels are friction fitted into clips. RSIC-1 clip for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) clip for use with 2-23/32 in. wide furring channels.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-1 (2.75)

6A. Steel Framing Members* — (Optional, Not Shown) — Furring channels and Steel Framing Members as described below:

A. Furring Channels — Formed of No. 25 MSG galv steel. Spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire. Gypsum board attached to furring channels as described in Item 4.

B. Steel Framing Members* — Used to attach furring channels (Item 6Aa) to studs. Clips spaced 48 in. OC., and secured to studs with 2 in. coarse drywall screw with 1 in. diam washer through the center hole. Furring channels are friction fitted into clips.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237R

6B. Steel Framing Members* — (Optional, Not Shown) — Furring channels and Steel Framing Members as described below:

A. Furring Channels — Formed of No. 25 MSG galv steel. Spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item 6Bb. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire. Gypsum board attached to furring channels as described in Item 4.

B. Steel Framing Members* — Used to attach furring channels (Item 6Ba) to studs. Clips spaced 48 in. OC., and secured to studs with 2-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.

REGUPOL AMERICA — Type SonusClip

6C. Steel Framing Members* — (Optional, Not Shown) — Resilient channels and Steel Framing Members as described below:

a. Resilient Channels — Formed of No. 25 MSG galv steel, spaced 24 in. OC, and perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and secured in place with two No. 8 15 x 1/2 in. Philips Modified Truss screws spaced 2-1/2 in. from the center of the overlap. Gypsum board attached to resilient channels as described in Item 4.

b. Steel Framing Members* — Used to attach resilient channels (Item 6Ca) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center hole. Resilient channels are secured to clips with one No. 10 x 1/2 in. pan-head self-drilling screw.

KEENE BUILDING PRODUCTS CO INC — Type RC+ Assurance Clip

7. **Furring Channel** — Optional — Not Shown — For use on one side of the wall with Item 4K — Resilient channels, 25 MSG galv steel, spaced vertically 24 in. OC, flange portion screw attached to one side of studs with 1-1/4 in. long diamond shaped point, double lead Phillips head steel screws. When resilient channels are used, insulation, Item 8 or 9 is required.

8. **Batts and Blankets*** — Required for use with resilient channels, Item 7, min. 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the nom 4 in. face of the studs with staples placed 24 in. OC.

ROCKWOOL — Type SAFEnSOUND

THERMAFIBER INC — Type SAFB, SAFB FF

9. **Batts and Blankets*** — (As an alternate to Item 8) — Min. 3 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, friction-fitted to fill the stud cavities. See Batts and Blankets (BKNV or BZ1Z) Categories for names of Classified companies.

9A. **Fiber, Sprayed*** — (Optional) — As an alternate to Batts and Blankets (Item 8), Required for use with resilient channels, Item 7, Not for use with Item 6, 6A, 6B, or 6C. — Spray applied mineral wool insulation. The fiber is applied with adhesive, at a minimum density of 4.0 pcf, to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. See Fiber, Sprayed (CCAZ).

AMERICAN ROCKWOOL MANUFACTURING, LLC — Type Rockwool Premium Plus

10. **Wall and Partition Facings and Accessories*** — (Optional, Not Shown) — Nominal 1/2 in. thick, 4 ft wide panels, for optional use as an additional layer on one or both sides of the assembly. Panels attached in accordance with manufacturer's recommendations. When the QR-500 or QR-510 panel is installed between the wood framing and the UL Classified gypsum board, the required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock QR-500 or QR-510

11. **Cementitious Backer Units*** — (Optional Item Not Shown — For Use On Face Of 2 Hr Systems With All Standard Items Required) — 7/16 in., 1/2 in., 5/8 in., 3/4 in. or 1 in. thick, min. 32 in. wide. Applied vertically with vertical joints centered over studs. Face layer fastened over gypsum board to studs and runners with cement board screws of adequate length to penetrate stud by a minimum of 3/8 in. for steel framing members, and a minimum of 3/4 in. for wood framing members spaced a max of 8 in. OC.

NATIONAL GYPSUM CO — Type DuraBacker, PermaBase, DuraBacker Plus, or PermaBase Plus

12. **Wall and Partition Facings and Accessories*** — (Optional, Not Shown) - When the Wall Assembly is used as an External Wall, on the External side of the wall one of the following Wall and Partition and Facing Accessories may be used, refer to items (A) to (C) below.

A. Non Insulated system with metal channels — Install moisture barrier over the Gypsum Board Item 4 and Install Acry Metal Channels vertically at a horizontal spacing not greater than 24 inches OC., over the moisture barrier. Acry Metal Channels attached through the moisture barrier and the Gypsum Board to the Wood Studs using fasteners specified by the manufacturer and fasteners spaced max., 24 in. OC. Install Acrytec Panels on Acry Metal Channels using 1-1/4" long corrosion coated stainless steel screws spaced at a max spacing of 24 inches OC, along with manufacturer's approved adhesive (3M 540 or Tremco Vulcum 116). Adhesive to be applied in a zigzag pattern along every channel. Joint treatment in between panels shall be Tremco illmod 600 pre compressed polyurethane foam sealant.

B. Insulated system with metal channels — Install moisture barrier over the Gypsum Board Item 4. Install galvanized Z girt channels specified by the manufacturer over the moisture barrier and the Gypsum Board Item 4. Z girt channels to be installed horizontally at a max. spacing of 24" OC. Z girt channels attached through the Gypsum Board and the moisture barrier to the wood studs with screws provided by the manufacturer at a max spacing of 24 inches OC. Install mineral wool insulation between the Z girts. Maximum thickness of mineral wool insulation not to exceed 6 in. As per manufacturer's instructions install Acry Metal Channels vertically over the Z girts at a max horizontal spacing of 24 in. OC. Acrytec Panels installed on Acry channel with 1-1/4" long corrosion coated stainless steel screws at a max spacing of 24 in. OC, along with manufacturers approved adhesive (3M 540 or Tremco Vulcum 116). Adhesive to be applied in a zigzag pattern along every channel. Joint treatment in between panels to be Tremco illmod 600 pre compressed polyurethane foam sealant.

C. Non insulated wood strapping system — Install moisture barrier over the Gypsum Board Item 4 and Install 1" x 3" wood strapping vertically at a horizontal spacing not greater than 24 inches OC., over the moisture barrier. 1" x 3" wood strapping attached through the moisture barrier and the Gypsum Board to the Wood studs using fasteners specified by the manufacturer and fasteners spaced max., 24 in. OC. Acrytec Panels to be installed on the 1" x 3" wood strapping using manufacturers approved stainless steel fasteners spaced at maximum 24 inches OC along with Tremco Vulcum 116 adhesive applied in a zigzag pattern along every wood strap. Joint treatment in between panels to be Tremco illmod 600 pre compressed polyurethane foam sealant.

D. **Insulated Wood Strapping System** — Install moisture barrier over the Gypsum Board Item 4. Install Extruded Polystyrene Insulation over moisture barrier and the Gypsum Board Item 4, max thickness of insulation not to exceed 4 inches. Install 1" x 3" wood strapping vertically at a horizontal spacing not greater than 24 inches OC. Wood strapping attached through the Insulation, the Gypsum Board and moisture barrier to the Wood Studs using fasteners specified by the manufacturer and fasteners spaced max. 24 in. OC. Acrytec Panels to be installed over the wood strapping using manufacturers approved stainless steel fasteners at a max spacing of 24 in. OC and Tremco Vulcum 116 adhesive applied in a zigzag pattern along every wood strap. Joint treatment in between panels to be Tremco illmod 600 pre compressed polyurethane foam sealant.

ACRYTEC PANEL INDUSTRIES — Nominal 5/8 inch thick Acrytec Panel.

13. **Foamed Plastic*** — (Optional - For use with Item 4Q) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

SES FOAM INC — SES 2 lb. Spray Foam and Sucraseal 0.5 lb. Spray Foam. For use in Bearing and Non-Load Bearing Walls.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2018-07-11

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BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

[See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States Design Criteria and Allowable Variances](#)

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Design No. U305

July 11, 2018

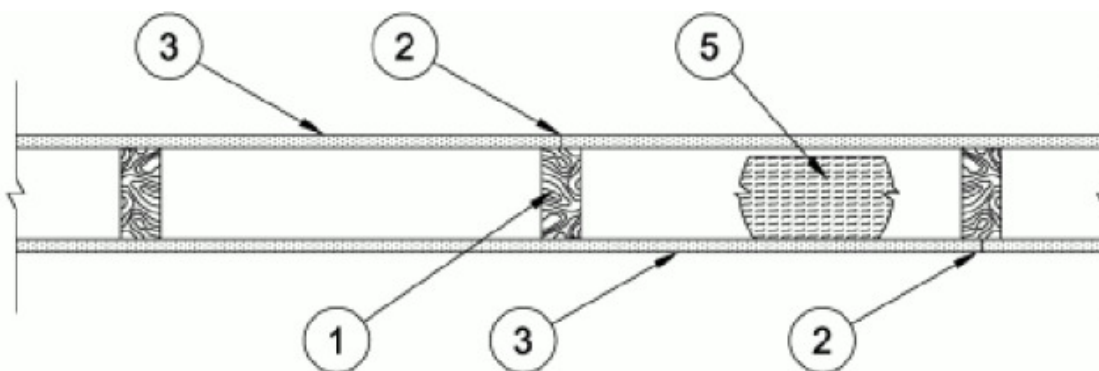
Bearing Wall Rating — 1 Hr

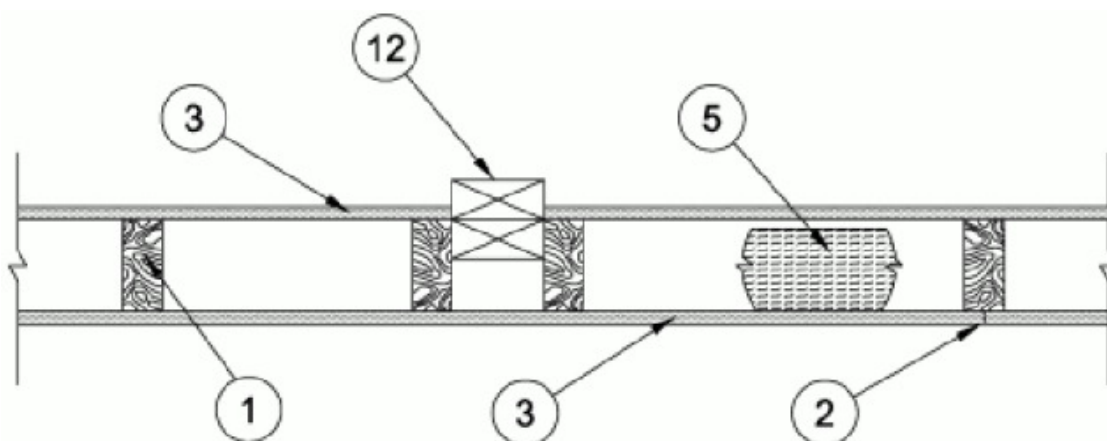
Finish Rating — See Items 3, 3A, 3D, 3E, 3F, 3G, 3H, 3J and 3L.

STC Rating - 56 (See Item 9)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide [BXUV](#) or [BXUV7](#)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**





1. **Wood Studs** — Nom 2 by 4 in. spaced 16 in. OC max, effectively firestopped.

2. **Joints and Nail-Heads** — Joints covered with joint compound and paper tape. Joint compound and paper tape may be omitted when square edge boards are used. As an alternate, nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard with the joints reinforced with paper tape. Nailheads exposed or covered with joint compound.

3. **Gypsum Board*** — 5/8 in. thick paper or vinyl surfaced, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. When used in widths other than 48 in., gypsum panels are to be installed horizontally. For an alternate method of attachment of gypsum panels, refer to Items 6 through 6E, **Steel Framing Members***.

When Items 6, 6B, 6C, 6D, or 6E, **Steel Framing Members***, are used, gypsum panels attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

When Item 6A, **Steel Framing Members***, is used, two layers of gypsum panels attached to furring channels. Base layer attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC. Face layer attached to furring channels with 1-5/8 in. long Type S bugle-head steel screws spaced 12 in. OC. All joints in face layers staggered with joints in base layers. One layer of gypsum board attached to opposite side of wood stud without furring channels as described in Item 3.

When Item 7, resilient channels are used, 5/8 in. thick, 4 ft wide gypsum panels applied vertically. Screw attached furring channels with 1 in. long, self-drilling, self-tapping Type S or S-12 steel screws spaced 8 in. OC, vertical joints located midway between studs.

ACADIA DRYWALL SUPPLIES LTD — Type X (finish rating 22 min), 5/8 Type X, Moisture Resistant Type X, Gypsum Sheathing Type X, Mold & Mildew Resistant Type X and Mold & Mildew Resistant AR Type X, Type Blueglass Exterior Sheathing

AMERICAN GYPSUM CO — Types AGX-1 (finish rating 23 min.), M-Glass (finish rating 23 min.), Type AGX-11 (finish rating 26 min), Type AGX-12 (finish rating 22 min), Type LightRoc (finish rating 23 min.) or Type AG-C

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1 (finish rating 24 min)

CERTAINTED GYPSUM INC — Type 1, Type SF3 (finish rating 20 min) or FRPC; Type C, Type X-2, Type X or Type X-1 (finish rating 26 min); Type EGRG or GlasRoc (finish rating 23 min), GlasRoc-2, Type Habito (finish rating 26 min).

CGC INC — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SCX (finish rating 24 min), Type SHX (finish rating 24 min), Type ULX (finish rating 22 min), Type WRC (finish rating 24 min), Type WRX (finish rating 24 min)

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC6A (finish rating 34 min), Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX (finish rating 21 min)

GEORGIA-PACIFIC GYPSUM L L C — Type 5 (finish rating 26 min), Type 6 (finish rating 23 min), Type 9 (finish rating 26 min), Type C (finish rating 26 min), Type DGG (finish rating 20 min), Type GPFS1 (finish rating 20 min), Type GPFS2 (finish rating 20 min), Type GPFS6 (finish rating 26 min), Type DS, Type DAP, Type DD (finish rating 20 min), Type DA, Type DAPC, Type LS (finish rating 23 min), Type X, Veneer Plaster Base - Type X, Water Rated - Type X, Sheathing - Type X, Soffit - Type X, Type LWX (finish rating 22 min), Veneer Plaster Base-Type LWX (finish rating 22 min),

Water Rated-Type LWX (finish rating 22 min), Sheathing Type-LWX (finish rating 22 min), Soffit-Type LWX (finish rating 22 min), Type DGLW (finish rating 22 min), Water Rated-Type DGLW (finish rating 22 min), Sheathing Type- DGLW (finish rating 22 min), Soffit-Type DGLW (finish rating 22 min), Type LWX (finish rating 22 min), Type LW2X (finish rating 22 min), Veneer Plaster Base - Type LW2X (finish rating 22 min), Water Rated - Type LW2X (finish rating 22 min), Sheathing - Type LW2X (finish rating 22 min), Soffit - Type LW2X (finish rating 22 min), Type DGL2W (finish rating 22 min), Water Rated - Type DGL2W (finish rating 22 min), Sheathing - Type DGL2W (finish rating 22 min)

NATIONAL GYPSUM CO — Type FSK (finish rating 20 min), Type FSK-G (finish rating 20 min), Type FSW (finish rating 20 min), Type FSW-2 (finish rating 24 min), Type FSW-3 (finish rating 20 min), Type FSW-5 (finish rating 22 min), Type FSW-G (finish rating 20 min), Type FSK-C (finish rating 20 min), Type FSW-C (finish rating 20 min), Type FSMR-C, Type FSW-6 (finish rating 20 min), Type FSL (finish rating 24 min), Type FSW-8, Type FSLX (finish rating 21 min).

NATIONAL GYPSUM CO — Riyadh, Saudi Arabia — Type FR, or WR.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types C, PG-2 (finish rating 20 min), PG-3 (finish rating 20 min), Types PG-3W, PG-5W (finish rating 20 min), Type PG-4 (finish rating 20 min), Type PG-6 (finish rating 23 min), Types PG-3WS, PG-5WS, PGS-WRS (finish rating 20 min), Types PG-5, PG-9 (finish rating 26 min), PG-11 PG-13 (Nails increased to 2 in.), or Type PG-C

PANEL REY S A — Type GREX, PRX, PRC, PRC2; Types RHX, MDX, ETX (finish rating 22 min)

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1 (finish rating 26 min)

THAI GYPSUM PRODUCTS PCL — Type C, Type X (finish rating 26 min)

UNITED STATES GYPSUM CO — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type FRX-G (finish rating 29 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SHX (finish rating 24 min), Type SCX (finish rating 24 min), Type SGX (finish rating 24 min), Type ULX (finish rating 22 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type ULIX (finish rating 20 min)

USG BORAL DRYWALL SFZ LLC — Type SGX (finish rating 24 min).

USG MEXICO S A DE C V — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SHX (finish rating 24 min), SCX (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type ULX (finish rating 22 min)

3A. Gypsum Board* — (As an alternate to Item 3) — 5/8 in. thick gypsum panels, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

AMERICAN GYPSUM CO — Types AGX-1 (finish rating 25 min.), M-Glass (finish rating 25 min.), AG-C (finish rating 25 min.), LighttRoc (finish rating 25 min.)

CERTAINTED GYPSUM INC — Type C, Type X-2, Type X or Type X-1 (finish rating 26 min)

CGC INC — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SCX (finish rating 24 min), Type SHX (finish rating 24 min), Type WRC (finish rating 24 min), Type WRX (finish rating 24 min)

NATIONAL GYPSUM CO — Type FSW (finish rating 24 min)

UNITED STATES GYPSUM CO — Type AR (finish rating 24 min), Type SCX (finish rating 24 min), Type SGX (finish rating 24 min), Type C (finish rating 24 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type IP-X1

(finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SHX (finish rating 24 min), Type FRX-G (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min)

USG BORAL DRYWALL SFZ LLC — Types C, SCX, SGX (finish rating 24 min).

USG MEXICO S A DE C V — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SHX (finish rating 24 min), Type SCX, Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min)

3B. **Gypsum Board*** — (As an alternate to Item 3) — Nom 3/4 in. thick, installed with 1-7/8 in. long cement coated nails as described in Item 3 or 1-3/8 in. long Type W coarse thread gypsum panel steel screws as described in Item 3A.

CGC INC — Types AR, IP-AR

UNITED STATES GYPSUM CO — Types AR, IP-AR

USG MEXICO S A DE C V — Types AR, IP-AR

3C. **Gypsum Board*** — (As an alternate to Items 3, 3A and 3B) — 5/8 in. thick, 2 ft wide, tongue and groove edge, applied horizontally to one side of the assembly. Installed with 1-7/8 in. long cement coated nails as described in Item 3 or 1-1/4 in. long Type W coarse thread gypsum panel steel screws as described in Item 3A. Joint covering (Item 2) not required.

CGC INC — Type SHX

UNITED STATES GYPSUM CO — Type SHX

USG MEXICO S A DE C V — Type SHX

3D. **Gypsum Board*** — (As an alternate to Items 3, 3A, 3B, or 3C — Not Shown) — For Direct Application to Studs Only— Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 1-1/2 in. wide, max 10 ft long with a max thickness of 0.125 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs or tabs may be used in lieu of or in addition to the lead batten strips or optional at other locations. Max 3/4 in. diam by max 0.125 in. thick lead discs compression fitted or adhered over steel screw heads or max 1/2 in. by 1-1/4 in. by max 0.125 in. thick lead tabs placed on gypsum boards underneath screw locations prior to the installation of the screws. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C".

RAY-BAR ENGINEERING CORP — Type RB-LBG (finish rating 24 min)

3E. **Gypsum Board*** — (As an alternate to Items 3, 3A, 3B, 3C, and 3D) — 5/8 in. thick gypsum panels, with square edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last 2 screws 1 and 4 in. from edge of board or nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

GEORGIA-PACIFIC GYPSUM L L C — Type DGG (finish rating 20 min), GreenGlass Type X (finish rating 23 min)

3F. **Gypsum Board*** — (As an alternate to Items 3, 3A, 3B, 3C, 3D, and 3E) — 5/8 in. glass-mat faced with square edges, applied either horizontally or vertically. Gypsum panels nailed 7 in. OC around the perimeter and in the field with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. Nails shall be placed 1 inch and 3 inch from horizontal joints and 7 inch OC thereafter.

CGC INC — Type USGX (finish rating 22 min)

UNITED STATES GYPSUM CO — Type USGX (finish rating 22 min.)

USG BORAL DRYWALL SFZ LLC — , Type USGX (finish rating 22 min.)

USG MEXICO S A DE C V — Type USGX (finish rating 22 min.)

3G. **Gypsum Board*** — (As an alternate to Items 3 through 3F) — 5/8 in. thick paper surfaced applied vertically. Gypsum panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads.

GEORGIA-PACIFIC GYPSUM L L C — Type X ComfortGuard Sound Deadening Gypsum Board (finish rating 27 min)

3H. **Gypsum Board*** — (As an alternate to Items 3) — Not to be used with items 6 or 7. 5/8 in. thick paper surfaced applied vertically only. Gypsum panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads.

NATIONAL GYPSUM CO — SoundBreak XP Type X Gypsum Board

3I. **Gypsum Board*** — (As an alternate to Items 3 through 3H, Not Shown) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically. Panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. Panel joints covered with paper tape and two layers of joint compound. Nailheads covered with two layers of joint compound.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock ES (finish rating 20 min)

3J. **Gypsum Board*** — (As an alternate to Item 3) — Not to be used with items 6 or 7. 5/8 in. thick paper surfaced applied vertically or horizontally. Gypsum panels secured per item 3 or 3A.

CERTAINTED GYPSUM INC — Type SilentFX

3K. **Gypsum Board*** — (As an alternate to Item 3) — 5/8 in. thick gypsum panels, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a maximum 8 in. OC with the last screw 1 in. from the edge of the board. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

NATIONAL GYPSUM CO — Type FSK (finish rating 20 min), Type FSK-G (finish rating 20 min), Type FSW (finish rating 20 min), Type FSW-2 (finish rating 24 min), Type FSW-3 (finish rating 20 min), Type FSW-5 (finish rating 22 min), Type FSW-G (finish rating 20 min), Type FSK-C (finish rating 20 min), Type FSW-C (finish rating 20 min), Type FSMR-C, Type FSW-6 (finish rating 20 min), Type FSL (finish rating 24 min).

3L. **Gypsum Board*** — (As an alternate to Item 3) — For Direct Application to Studs Only — Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 10 ft long with a max thickness of 0.140 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, max 5/16 in. diam by max 0.140 in. thick. Compression fitted or adhered over the screw heads. Lead batten strips to have a purity of 99.5% meeting the Federal specification QQ-L-201f, Grades "B, C or D".

MAYCO INDUSTRIES INC — "X-Ray Shielded Gypsum"

3M. **Gypsum Board*** — (As an alternate to Items 3) — For Direct Application to Studs Only — For use as the base layer or as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 8 ft long with a max thickness of 0.14 in. placed on the face of studs and attached to the stud with construction adhesive and two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, nominal 3/8 in. diam by max 0.085 in. thick. Compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

RADIATION PROTECTION PRODUCTS INC — Type RPP - Lead Lined Drywall

3N. **Gypsum Board*** — (As an alternate to Item 3) — 5/8 in. thick, 4 ft. wide, applied horizontally or vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Secured as described in Item 3 or 3A.

CERTAINTED GYPSUM INC — Easi-Lite Type X (finish rating 24 min), Easi-Lite Type X-2 (finish rating 24 min)

3O. **Wall and Partition Facings and Accessories*** — (As an alternate to Item 3, Not Shown) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically. Panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. Panel joints covered with paper tape and two layers of joint compound. Nailheads covered with two layers of joint compound.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527 (finish rating 24 min).

3P. **Gypsum Board*** — (As an alternate to Item 3, Not Shown) — Two layers nom. 5/16 in. thick gypsum panels applied vertically or horizontally. Horizontal edge joints and horizontal butt joints on opposite sides of studs need not be staggered or backed by wood studs. Horizontal joints on the same side between face and base layers need not be staggered. Base layer gypsum panels fastened to studs with 1-1/4 in. long drywall nails spaced 8 in. OC. Face layer gypsum panels fastened to studs with 1-7/8 in. long drywall nails spaced 8 in. OC starting with a 4" stagger.

NATIONAL GYPSUM CO — Type FSW (finish rating 25 min)

3Q. **Gypsum Board*** — (As an alternate to Item 3) — 5/8 in. thick gypsum panels, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a maximum 10 in. OC with the last two screws 4 and 1 in. from the edges of the board. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC6A (finish rating 21 min), Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX

3R. **Gypsum Board*** — (As an alternate to Item 3. For use with Item 5H) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board listed in Item 3 above. Applied either horizontally or vertically, and screwed to panels with 1-5/8 in. long Type W coarse thread steel screws at 8 in. OC at perimeter and in the field with the last two screws 4 and 3/4 in. from the edges of the board when applied as the base layer. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

3S. **Gypsum Board*** — 3/4 in. thick paper or vinyl surfaced, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels secured as described in Item 3 with nail length increased to 2 in.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type PG-13

4. **Steel Corner Fasteners** — (Optional) — For use at wall corners. Channel shaped, 2 in. long by 1 in. high on the back side with two 1/8 in. wide cleats protruding into the 5/8 in. wide channel, fabricated from 24 gauge galv steel. Fasteners applied only to the end or cut edge (not along tapered edges) of the gypsum board, no greater than 2 in. from corner of gypsum board, max spacing 16 in. OC. Nailed to adjacent stud through tab using one No. 6d cement coated nail per fastener. Corners of wall board shall be nailed to top and bottom plate using No. 6d cement coated nails.

5. **Batts and Blankets*** — (Optional — Required when Item 6A is used (RC-1)) — Glass fiber or mineral wool insulation. Placed to completely or partially fill the stud cavities. When Item 6A is used, glass fiber or mineral wool insulation shall be friction-fitted to completely fill the stud cavities.

CERTAINTED CORP

JOHNS MANVILLE

KNAUF INSULATION LLC

MANSON INSULATION INC

OWENS CORNING HT INC, DIV OF OWENS CORNING — Corning Fiberglas Corp

ROCK WOOL MANUFACTURING CO — Delta Board

ROCKWOOL — Acoustical Fire Batts

THERMAFIBER INC — Type SAFB, SAFB FF

5A. **Fiber, Sprayed*** — (Not Shown — Not for use with Item 6) — As an alternate to Batts and Blankets (Item 5) — Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product with a nominal dry density of 2.7 lb/ft³. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product. When Item 6B is used, Fiber, Sprayed shall be INS735, INS745, INS765LD or INS770LD.

U S GREENFIBER L L C — INS735& INS745 for use with wet or dry application. INS510LD, INS515LD, INS541LD, INS735, INS745, INS765LD, and INS770LD are to be used for dry application only

5B. **Fiber, Sprayed*** — (Not Shown - Not for use with Item 6) — As an alternate to Batts and Blankets (Item 5) and Item 5A - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft.

NU-WOOL CO INC — Cellulose Insulation

5C. **Batts and Blankets*** — Required for use with resilient channels, Item 7, 3 in. thick mineral wool batts, friction-fitted to fill interior of wall.

THERMAFIBER INC — Type SAFB, SAFB FF

5D. **Glass Fiber Insulation** — (As an alternate to Item 5C) — 3 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, friction-fitted to fill the interior of the wall. See **Batts and Blankets** (BKNV or BZJZ) Categories for names of Classified companies.

5E. **Batts and Blankets*** — (Required for use with Wall and Partition Facings and Accessories, Item 3D) — Glass fiber insulation, nom 3-1/2 in. thick, min. density of 0.80 pcf, with a flame spread of 25 or less and a smoke developed of 50 or less, friction-fitted to completely fill the stud cavities. See Batts and Blankets Category (BKNV) for names of manufacturers.

5F. **Fiber, Sprayed*** — (Optional, Not Shown — Not for use with Items 6, 6A, 6B, 6C, or 6D) — As an alternate to Batts and Blankets (Item 5) and Item 5A - Spray applied granulated mineral fiber material. The fiber is applied with adhesive, at a minimum density of 4.0 pcf, to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. See **Fiber, Sprayed** (CCAZ).

AMERICAN ROCKWOOL MANUFACTURING, LLC — Type Rockwool Premium Plus

5G. **Fiber, Sprayed*** — (Optional, Not Shown — Not for use with Items 6, 6A, 6B, 6C, or 6D). — As an alternate to Batts and Blankets (Item 5) and Item 5A - Brown Colored Spray applied cellulose fiber. The fiber is applied with water to completely fill the enclosed stud cavity in accordance with the application instructions supplied with the product. The minimum dry density shall be 4.30 lbs/ft³.

INTERNATIONAL CELLULOSE CORP — Celbar-RL

5H. **Foamed Plastic*** — (Optional -For use with Item 3R) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

SES FOAM INC — SES 2 lb. Spray Foam and Sucraseal 0.5 lb. Spray Foam.

6. **Steel Framing Members*** — (Optional, Not Shown) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel. 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Gypsum board attached to furring channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6a) to studs. Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to studs with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75)

6A. **Steel Framing Members*** — (Optional, Not Shown) — Furring channels and Steel Framing Members on one side of studs as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Batts and Blankets placed in stud cavity as described in Item 5. Two layers of gypsum board attached to furring channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Aa) to one side of studs only. Clips spaced 48 in. OC., and secured to studs with two No. 8 x 2-1/2 in. coarse drywall screws, one through the hole at each end of the clip. Furring channels are friction fitted into clips.

KINETICS NOISE CONTROL INC — Type Isomax

6B. **Steel Framing Members*** — (Optional, Not Shown) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel. 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the

midpoint of the overlap, with one screw on each flange of the channel. Gypsum board attached to furring channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Ba) to studs. Clips spaced 48 in. OC. Genie clips secured to studs with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.

PLITEQ INC — Type Genie Clip

6C. **Steel Framing Members*** — (Optional, Not Shown) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel. Spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire. Gypsum board attached to furring channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Ca) to studs. Clips spaced 48 in. OC., and secured to studs with No. 2 in. coarse drywall screw with 1 in. diam washer through the center hole. Furring channels are friction fitted into clips.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237 or A237R

6D. **Steel Framing Members*** — (Optional, Not Shown) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel, spaced 24 in. OC, and perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and secured in place with a double strand of No. 18 AWG twisted steel wire. Gypsum board attached to furring channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Da) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.

REGUPOL AMERICA — Type SonusClip

6E. **Steel Framing Members*** — (Optional, Not Shown) — Resilient channels and Steel Framing Members as described below:

a. **Resilient Channels** — Formed of No. 25 MSG galv steel, spaced 24 in. OC, and perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and secured in place with two No. 8 15 x 1/2 in. Phillips Modified Truss screws spaced 2-1/2 in. from the center of the overlap. Gypsum board attached to resilient channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach resilient channels (Item 6Ea) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center hole. Resilient channels are secured to clips with one No. 10 x 1/2 in. pan-head self-drilling screw.

KEENE BUILDING PRODUCTS CO INC - Type RC+ Assurance Clip

7. **Furring Channel** — Optional — Not Shown — For use on one side of the wall - Resilient channels, 25 MSG galv steel, spaced vertically 24 in. OC, flange portion screw attached to one side of studs with 1-1/4 in. long diamond shaped point, double lead Phillips head steel screws. When resilient channels are used, insulation, Items 5C or 5D is required.

8. **Caulking and Sealants** — (Not Shown, Optional) — A bead of acoustical sealant applied around the partition perimeter for sound control.

9. **STC Rating** — The STC Rating of the wall assembly is 56 when it is constructed as described by Items 1 through 6, except:

A. Item 2, above — Nailheads Shall be covered with joint compound.

B. Item 2, above — Joints As described, shall be covered with fiber tape and joint compound.

C. Item 5, above — Batts and Blankets* The cavities formed by the studs shall be friction fit with R-19 unfaced fiberglass insulation batts measuring 6-1/4 in. thick and 15-1/4 in. wide.

D. Item 6, above — Steel Framing Members* Type RSIC-1 clips shall be used to attach gypsum board to studs on either side of the wall assembly.

E. Item 8, above — Caulking and Sealants (Not Shown) A bead of acoustical sealant shall be applied around the partition perimeter for sound control.

F. Steel Corner Fasteners (Item 4), Fiber, Sprayed (Items 5A and 5B) and Steel Framing Members (Item 6A), not evaluated as alternatives for obtaining STC rating.

10. **Wall and Partition Facings and Accessories*** — (Optional, Not Shown) — Nominal 1/2 in. thick, 4 ft wide panels, for optional use as an additional layer on one or both sides of the assembly. Panels attached in accordance with manufacturer's recommendations. When the QR-500 or QR-510 panel is installed between the wood framing and the UL Classified gypsum board, the required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock QR-500 and QR-510

11. **Cementitious Backer Units*** — (Optional Item Not Shown — For Use On Face Of 1 Hr Systems With All Standard Items Required) - 7/16 in., 1/2 in., 5/8 in., 3/4 in. or 1 in. thick, min. 32 in. wide. Applied vertically or horizontally with vertical joints centered over studs. Fastened to studs and runners with cement board screws of adequate length to penetrate stud by a minimum of 3/8 in. for steel framing members, and a minimum of 3/4 in. for wood framing members spaced a max of 8 in. OC. When 4 ft. wide boards are used, horizontal joints need not be backed by framing.

NATIONAL GYPSUM CO — Type DuraBacker, PermaBase, DuraBacker Plus, or PermaBase Plus

12. **Non-Bearing Wall Partition Intersection** — (Optional) —Two nominal 2 by 4 in. studs or nominal 2 by 6 in. studs nailed together with two 3 in. long 10d nails spaced a max. 16 in. OC. vertically and fastened to one side of the minimum 2 by 4 in. stud with 3 in. long 10d nails spaced a max. 16 in. OC. vertically. Intersection between partition wood studs to be flush with the 2 by 4 in. studs. The wall partition wood studs are to be framed by with a second 2 by 4 in. wood stud fastened with 3 in. long 10d nails spaced a max. 16 in. OC. vertically. Maximum one non-bearing wall partition intersection per stud cavity. Non-bearing wall partition stud depth shall be at a minimum equal to the depth of the bearing wall.

13. **Mesh Netting** — (Not Shown) — Any thin, woven or non-woven fibrous netting material attached with staples to the outer face of one row of studs to facilitate the installation of the sprayed fiber from the opposite row.

14. **Mineral and Fiber Board*** — (Optional, Not Shown) — For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with minimum 1-3/8 in. long ring shanked nails or 1-1/4 in. long Type W steel screws, spaced 12 in. OC. The required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

14A. **Mineral and Fiber Board*** — (Optional, Not Shown) — For use with Items 14B-14E) — For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with minimum 1-3/8 in. long ring shanked nails or 1-1/4 in. long Type W steel screws, spaced 12 in. OC along board edges and 24 in. OC in field of board along intermediate framing. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

14B. **Glass Fiber Insulation** — (For use with Item 14A) — 3-1/2 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, placed to fill the interior of the wall. See Batts and Blankets (BKNV or BZJZ) categories for names of Classified companies.

14C. **Batts and Blankets*** — (As an alternate to Item 14B, For use with Item 14A), 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the 3-1/2 in. face of the studs with staples placed 24 in. OC.

THERMAFIBER INC — Type SAFB, SAFB FF

14D. **Adhesive** — (For use with Item 14A) — Construction grade adhesive applied in vertical, serpentine, nominal 3/8 in. wide beads down the length of both vertical edges of Mineral and Fiber Board (Item 14A).

14E. **Gypsum Board*** — (For use with Item 14A) — 5/8 in. thick, 4 ft wide, applied vertically over Mineral and Fiber Board (Item 14A) with vertical joints located anywhere over stud cavities. Secured to mineral and fiber boards with 1-1/2 in. Type G Screws spaced 8 in. OC along edges of each vertical joint and 12 in. OC in intermediate field of the Mineral and Fiber Board (Item 14A). Secured to outermost studs and bearing plates with 2 in. long Type S screws spaced 8 in. OC. Gypsum Board joints covered with paper tape and joint compound. Screw heads covered with joint compound. Finish Rating 30 Min.

AMERICAN GYPSUM CO — Type AG-C

CERTAINTED GYPSUM INC — Type FRPC, Type C, Type X-2

CGC INC — Types C, IP-X2, IPC-AR

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

NATIONAL GYPSUM CO — Types FSK-C, FSW-C

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type PG-C

PANEL REY S A — Type PRC

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

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Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

[See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States](#)
[Design Criteria and Allowable Variances](#)

[See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada](#)
[Design Criteria and Allowable Variances](#)

Design No. U905

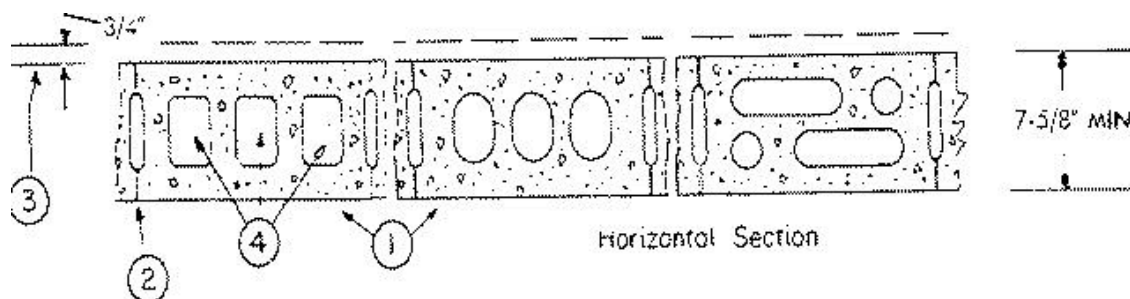
April 09, 2018

Bearing Wall Rating — 2 HR.

Nonbearing Wall Rating — 2 HR

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide [BXUV](#) or [BXUV7](#)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Concrete Blocks*** — Various designs. Classification D-2 (2 hr).

See **Concrete Blocks** category for list of eligible manufacturers.

2. **Mortar** — Blocks laid in full bed of mortar, nom. 3/8 in. thick, of not less than 2-1/4 and not more than 3-1/2 parts of clean sharp sand to 1 part Portland cement (proportioned by volume) and not more than 50 percent hydrated lime (by cement volume). Vertical joints staggered.

3. **Portland Cement Stucco or Gypsum Plaster** — Add 1/2 hr to classification if used. Where combustible members are framed in wall, plaster or stucco must be applied on the face opposite framing to achieve a max. Classification of 1-1/2 hr. Attached to concrete blocks (Item 1).

4. **Loose Masonry Fill** — If all core spaces are filled with loose dry expanded slag, expanded clay or shale (Rotary Kiln Process), water repellent vermiculite masonry fill insulation, or silicone treated perlite loose fill insulation add 2 hr to classification.

5. **Foamed Plastic*** — (Optional-Not Shown) — 1-1/2 in. thick max, 4 ft wide sheathing attached to concrete blocks (Item 1).

ATLAS ROOFING CORP — "EnergyShield Pro Wall Insulation", "EnergyShield Pro 2 Wall Insulation", EnergyShield CGF Pro and EnergyShield Ply Pro

CARLISLE COATINGS & WATERPROOFING INC — Type R2+ SHEATHE

FIRESTONE BUILDING PRODUCTS CO L L C — "Enverge™ CI Foil Exterior Wall Insulation" and "Enverge™ CI Glass Exterior Wall Insulation"

HUNTER PANELS — Types Xci-Class A, Xci 286

RMAX OPERATING L L C — "TSX-8500", "TSX-8510", "Thermasheath-XP", "ECOMAXci", "Thermasheath-3", "Durasheath-3"

THE DOW CHEMICAL CO — Types Thermax Sheathing, Thermax Light Duty Insulation, Thermax Heavy Duty Insulation, Thermax Metal Building Board, Thermax White Finish Insulation, Thermax ci Exterior Insulation, Thermax XARMOR ci Exterior Insulation, Thermax IH Insulation, Thermax Plus Liner Panel, Thermax Heavy Duty Plus (HDP) and TUFF-R™ ci Insulation

5A. **Building Units** — As an alternate to Items 5, min. 1-in thick polyisocyanurate composite foamed plastic insulation boards, nom. 48 by 48 or 96 in.

RMAX OPERATING L L C — "Thermasheath-SI", "ECOBASEci", "ThermaBase-CI"

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**SUBSURFACE SOIL EXPLORATION
ANALYSIS AND RECOMMENDATIONS
PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
SOUTH PART OF ALICO INTERCHANGE PARK
SWC OF I-75 AND ALICO ROAD
FORT MYERS, LEE COUNTY, FLORIDA**



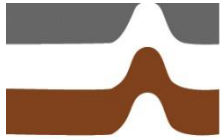
Ardaman & Associates, Inc.

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

Ardaman Project No. 18-33-4520
June 14, 2018

COURTELIS COMPANY

703 Waterford Way, Suite 800
Miami, FL 33126

Attention: Mr. Elias Vassilaros

SUBJECT: Subsurface Soil Exploration
Analysis and Recommendations
Proposed Multi-Family Residential Development
South Part of Alico Interchange Park
SWC of I-75 and Alico Road
Fort Myers, Lee County, Florida

Gentlemen:

As requested and authorized by **Courtelis Company**, Ardaman & Associates, Inc. (Ardaman) has completed the subsurface soil exploration program for the subject project. The purposes of this program were to evaluate the general subsurface conditions at the site and provide recommendations for site preparation and foundation design.

This report documents our findings and conclusions. It has been prepared for the exclusive use of **Courtelis Company** for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services was limited to the following items:

1. Conducting 12 Standard Penetration Test (SPT) borings and three test pits to determine the nature and condition of the subsurface soils.
2. Reviewing each soil sample obtained in our field exploration program by a geotechnical engineer in our laboratory for further identification and assignment of laboratory tests.

3. Performing the appropriate laboratory tests on selected samples.
4. Analyzing the existing soil conditions with respect to the proposed construction as it relates to foundation design.
5. Preparing this report to document the results of our field exploration, engineering analysis and foundation design recommendations.

SITE LOCATION

The proposed multi-family development will be located on a parcel south of Alico Road, west of Interstate 75 and east of Three Oaks Parkway in Fort Myers, Lee County, Florida. The Lee County Property Appraiser identifies the lot by STRAP No. 10-46-25-00-00001.1000. A **Site Location Map** is presented as **Figure 1**.

The parcel is presently used for cattle grazing. The north and east areas of the site are heavily wooded. The southeast corner of the site has a pond. Based on historical aerial photograph review, we understand the south part of the site was a pond excavated for soil borrow purposes and subsequently partially filled in between 2007 and 2012.

FIELD EXPLORATION PROGRAM

Our field exploration consisted of performing 12 Standard Penetration Test (SPT) borings. The SPT borings were drilled to depths of 20, 30 and 35 feet below the existing ground surface. The SPT borings were conducted using methods consistent with ASTM D-1586. The equipment and procedures used in the SPT borings are described in detail in the **Appendix**.

Our field exploration also included the excavation of three test pits. The test pits were excavated by others using a Komatsu bucket excavator. The test pits were generally excavated to a depth of 17 feet below the existing ground surface, except for test pit location TP-1, which encountered refusal at 6.5 feet due to rock

The locations of the borings and test pits are shown on the attached **Test Location Plan (Figure 2)**. The test locations were identified in the field by reference to an aerial photograph obtained from the Lee County Property Appraiser's website. Therefore, the locations indicated should be considered accurate only to the degree implied by the method of measurement used. If a more precise location of the borings is desired, then we recommend that a registered land surveyor be employed to locate the borings on site. GPS coordinates of each boring location are provided on the boring logs.

GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions encountered during the field exploration are shown on the attached soil boring and test pit logs. Soil stratification is based on examination of recovered soil samples and interpretation of the field boring logs. The stratification lines represent the approximate boundaries between the soil types, the actual transitions may be gradual.

The general soil profile consisted of very loose to dense fine sands (SP) and slightly silty fine sands (SP-SM/SM) from the ground surface to depths ranging from 4 to 12.5 feet below the existing ground surface. Below the fine sands, the borings typically encountered very loose to dense silty fine sands (SM) and silty clayey fine sands (SC-SM) extending to depths ranging from 7.5 to 22.5 feet below the existing ground surface. Below this the borings encountered alternating layers of very loose to medium dense slightly silty sands (SP-SM), very loose to medium dense silty sands (SM), very loose fine sands (SP), very loose to medium dense silty clayey sands (SC-SM) and very loose to loose sandy silt (ML) with varying amounts (if any) of gravel consisting of cemented sands and rock fragments extending to the termination of the borings at depths of 20, 30 and 35 feet below the existing ground surface. Borings SPT-1 and SPT-3 encountered loose clayey sands (SC) or hard sandy lean clays (CL) near the termination of the borings at about 32.5 feet extending to the termination of the borings at 35 feet. Also, borings SPT-3 through SPT-5 and SPT-8 through SPT-11 encountered soft weathered to hard limestone at depths ranging from 7.5 to 11 feet extending to depths ranging from 11 to 17 feet below the existing ground surface. In addition, test pits TP-1 thru TP-3 encountered weathered limestone at depths ranging from approximately 6.5 to 12 feet extending to depths of 12 and 14 feet below the existing ground surface.

Groundwater was encountered in the test pits at depths ranging from 6 to 9 feet below the existing ground surface at the time of our field exploration (May 10th, 2018). Groundwater was encountered in the boreholes at depths ranging from 4 to 7 feet below the existing ground surface at the time of our field exploration (April 18th and 20th, 2018, and June 6 and 7, 2018). The groundwater depths shown on the boring logs represent the groundwater surface encountered on the dates shown. Fluctuations in groundwater level should be anticipated throughout the year due to seasonal variations in rainfall, and other factors.

LABORATORY TESTING PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our office and, thereafter, examined by a geotechnical engineer to obtain more

accurate descriptions of the existing soil strata. Laboratory testing was performed on selected samples as deemed necessary to aid in soil classification and to further define the engineering properties of the soils. The laboratory tests included Natural Moisture Content and Percent Finer than the U.S. No. 200 Sieve (percent silt and clay).

The test results are presented on the attached soil boring logs at the depths from which the samples were recovered. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

PROPOSED CONSTRUCTION

The proposed multi-family development is planned to include two 4-story wood-framed apartment buildings with floor slab-on-grade. We also understand the proposed development will include parking/drive areas and a lake for fill dirt and stormwater management. We anticipate site grading to include approximately 2 to 3 feet of site filling.

For the purposes of evaluating the bearing capacity and settlement values, we have been given maximum loading conditions of 50 kips for individual column footings and 6 kips per lineal foot for continuous wall footings. The recommendations contained in this report will not necessarily apply if loading conditions are in excess of the above assumed loading conditions.

ANALYSIS AND RECOMMENDATION

In view of our findings, subsurface conditions appear to be adequate for shallow foundation support of the proposed four-story structures with the floor slabs supported on grade. Note that these structures will have limitations on maximum column loads of less than about 100 kips and maximum wall loads of less than about 11 kips per lineal foot. Structures with heavier column or wall loads may require additional ground improvement such as vibro-replacement to limit settlements to tolerable levels.

Filling of the existing pond for support of the proposed multi-family buildings and surface parking will require dewatering of the pond so that the backfill soils may be placed under dry conditions. End-dumping and pushing fill soils into the pond up to grade without any compactive effort will in our opinion be insufficient to allow use of spread footing foundation design for support of any structures. Intolerable ground surface settlement will likely result over time.

The following are our recommendations for overall site preparation and foundation design that we feel are best suited for the proposed development and existing soil conditions. These recommendations are made as a guide for the design engineer and/or architect, parts of which should be incorporated into the project's general specifications.

SITE PREPARATION:

1. Each building area "footprint" and parking/drive areas, plus a minimum margin of 5 feet, should be stripped and grubbed of all surface vegetation, debris or other deleterious material, as encountered. During the clearing and grubbing operation, roots with a diameter greater than 1-inch or small roots in high density should be completely removed. These materials should be disposed of in areas designated by the Owner.
2. The cleared surfaces in construction areas should be proofrolled using the appropriate compaction equipment for site and soil conditions. Adjust the moisture content of the soil, as necessary, to aid compaction. Sufficient passes should be made to develop a minimum dry density of 95 percent of the Modified Proctor Maximum Dry Density (ASTM D-1557) to a depth of 12 inches below the compacted surface. Replace all material, if determined to be deleterious, in areas that "yield" during the proofrolling operation and replace with suitable fill material conforming to that stated in Item 4.
3. After satisfactory proofrolling of the cleared surface in accordance with the above, filling with suitable material may proceed. Fill material should conform to that stated in Item 4 below. The fill should be placed in level lifts not exceeding 12 inches in uncompacted thickness. Each lift should be compacted by repeated passes with appropriate compaction equipment to achieve at least 95 percent of the Modified Proctor Maximum Dry Density (ASTM D-1557). The filling and compaction operations should continue until the desired elevation(s) is achieved.
4. Fill material should preferably consist of clean to slightly silty fine sands (SP or SP-SM), free of organic or other deleterious materials, with less than 12 percent passing the U.S. Sieve No. 200.
5. Excavate the continuous wall footing lines and/or column footings to the proposed bottom of footing elevations and, thereafter, verify the in-place compaction. If necessary, compact the bottom of the excavations to achieve a minimum dry density of 95 percent of the Modified Proctor Maximum Dry Density (ASTM D-1557). This density should be developed to a minimum depth of 12 inches below the bottom of the footings.

Over-excavate and recompact, as necessary, to fulfill the above compaction criteria. The moisture content of the foundation soils must be controlled during the compaction procedure to aid compaction.

6. Ardaman should be employed by the Owner to observe and test all prepared and compacted areas to document that all unsuitable soils are removed and that the foundation and fill soils are prepared and compacted in accordance with the above recommendations.

FOUNDATION DESIGN:

Foundation soils prepared in accordance with the above recommendations should be suitable for supporting the proposed structure on an economical and conventionally designed shallow foundation system. The foundations may be designed for an allowable net soil contact pressure of 2500 pounds per square foot (psf) or less.

Column footings should be a minimum of 24 inches wide and wall footings should be a minimum of 18 inches wide. Minimum soil coverage of 12 inches should be maintained from the bottom of the exterior foundations to the adjacent outside finished grades.

Based on the boring information and the assumed loading conditions, the recommended allowable net soil contact pressure will yield a minimum factor of safety in excess of two against bearing capacity failure. The total settlement is estimated to be 1 inch or less, and differential settlement between adjacent footings is estimated to be $\frac{3}{4}$ inch or less. Because foundation soils are mostly coarse-grained, the majority of settlement will occur during construction as the load is being applied.

UTILITY EXCAVATION:

Fine sands (SP) and slightly silty fine sands (SP-SM/SM) are anticipated to be at the ground surface extending to depths ranging from 4 to 17.5 feet below the existing ground surface. These soil types are suitable bedding materials and suitable for reuse as backfill.

Below the sands, strata of silty and silty clayey sands (SM and SC-SM) and limestone rock, are anticipated to be encountered. These are unsuitable materials for use as bedding and backfill and we recommend bedding all pipe in at least 6 inches of gravel such as FDOT No. 89 Stone, if unsuitable soil types or conditions are encountered at pipe invert elevation.

REUSE OF ENCOUNTERED MATERIALS IN THE TEST BORINGS/TEST PITS:**Poorly Graded Sand (SP)**
Poorly Graded Sands with Silt (SP-SM)

These sands contain less than 12 percent fines. Sands excavated below the water table should be stockpiled to drain excess moisture. These soil types were encountered typically to depths of 4 to 12.5 feet.

These soil types are suitable as unprocessed fill for use as structural fill. They are also suitable for use in roadway and parking lot embankments and subgrades and as general landscaping fill. Drainage or permeability characteristics of SP materials are good.

Silty Sand (SM)
Silty Clayey Sand (SC-SM)

These silty sands typically contain less than about 35 percent non-plastic or low plasticity fines and are generally suitable for use in roadway and parking lot embankments; however, careful control of the moisture content is needed to achieve required compaction. This soil type was typically encountered at depths of 4 to 12.5 feet generally extending to the termination of the borings at depths of 20, 30 and 35 feet below the existing ground surface. Note, boring SPT-4 encountered a 1-1/2-foot thick stratum of silty clayey fine sands at a depth of 3 feet.

Soft Weathered Limestone
Hard Limestone

Hard limestone or soft weathered limestone were encountered in test locations SPT-2 through SPT-4, SPT-8 through SPT-11 and TP-1 through TP-3 at depths ranging from 6.5 to 12 feet extending to depths ranging from 10 to 17 feet below the existing ground surface. The soft limestone appears as a partially cemented gravelly slightly silty to silty fine sand (SP-SM/SM). As such it is a suitable material for use in roadway/parking lot embankments and subgrades. Cobble and boulder-size fragments should be expected throughout the soft limestone stratum. Soft limestone can typically be excavated with a large excavator. Hard limestone will require use of pneumatic chisels, hoe rams or similar dynamic tools to remove the rock when encountered in an excavation. Use of rock or boulder and cobble-size fragments will require crushing to reduce particle sizes. Typically, we recommend no individual pieces larger than 3-1/2 inches in the upper 1-foot, 6-inches between 1 and 2 feet and 12 inches below a depth of 2 feet. Note that at test pit locations TP-2 and TP-3 the limestone was removed by the bucket excavator; however, at TP-1 the excavator could not remove, hence termination of the test pit on rock.

Sandy Silts (ML)
Clayey Sand (SC)
Sandy Lean Clay (CL)

These plastic sandy silts, clayey sands and sandy clays are not suitable for reuse as structural fill nor may they be used under roadway or parking lot embankments. Reuse will be limited to non-structural areas used as berms. This material will be very difficult to work because of the high moisture content and high plastic fines content. This soil was typically encountered below depths of 25 feet below the existing ground surface.

COMPACTION RECOMMENDATIONS SUMMARY:

Below is a summary of compaction recommendations for various project elements. We recommend a moisture content range of -4 to +2 percent of the optimum moisture content at the time of compaction as determined by Modified Proctor (ASTM D-1557) procedure.

<u>Location</u>	<u>Percent Compaction ASTM D-1557</u>	<u>Depth</u>	<u>Recommended Test Frequency</u>
Bottom of Footings	95	12 inches	at column footings and every 75 l.f. of wall footing per 2,500 s.f. per 2,500 s.f. per lift
Slab Subgrade	95	12 inches	
Structural Fill	95	full depth	
<u>Paving</u>			
limerock base	98	full thickness	per 10,000 s.f.
stabilized subgrade	98	full thickness	per 10,000 s.f.
embankment	95	full depth	per 5,000 s.f. per lift
Utility Trenches (in paved area)	95	full depth	per 300 l.f. alternate lifts
Utility Trenches (outside paved area)	90	full depth	per 300 l.f. alternate lifts
Beneath Sidewalks and Exterior Slabs	95	12 inches	per 5,000 s.f.

GENERAL COMMENTS

The analysis and recommendations in this report are based on the data obtained from the 12 soil borings and three test piles performed at the approximate locations indicated on the attached **Figure 2–Boring Location Plan**.

This report does not reflect any variations that may occur between the borings. The nature and extent of variations may not become evident until during the course of construction. If variations then appear evident, it will be necessary for a reevaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

When the final design and specifications are completed, we would like the opportunity to review them to determine whether changes in the original concept may have affected the validity of our recommendations and whether these recommendations have been implemented in the design and specifications.

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The boring logs and related information are based on the driller's logs and visual examination of selected sample in the laboratory. The delineation between soil types shown on the logs is approximate and the description represents our interpretation of subsurface conditions at the designated boring locations and on the particular date drilled.

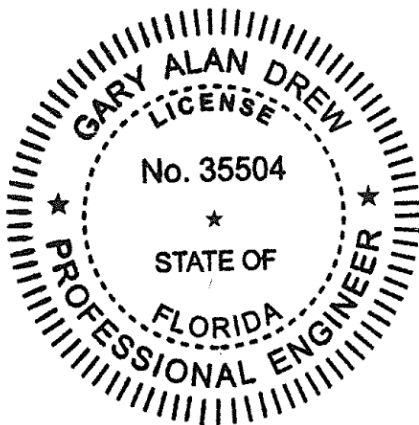
If you have any questions about this report, please contact this office.

Very truly yours,

Ardaman & Associates, Inc.
Florida Certificate of Authorization No. 00005950



Matthew R. Elmore, E.I.
Project Engineer



*This document has been digitally
signed and sealed by:*

Gary A Drew
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Gary A. Drew, P.E. No. 35504
Vice President/Branch Manager

MRE:GAD/cmb

ATTACHMENTS

- **SITE LOCATION MAP (FIGURE 1)**
- **BORING LOCATION PLAN (FIGURE 2)**
- **BORING LOGS – SPT-1 THROUGH SPT- 12**
- **TEST PIT LOGS – TP-1 THROUGH TP-3**

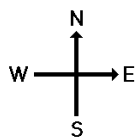
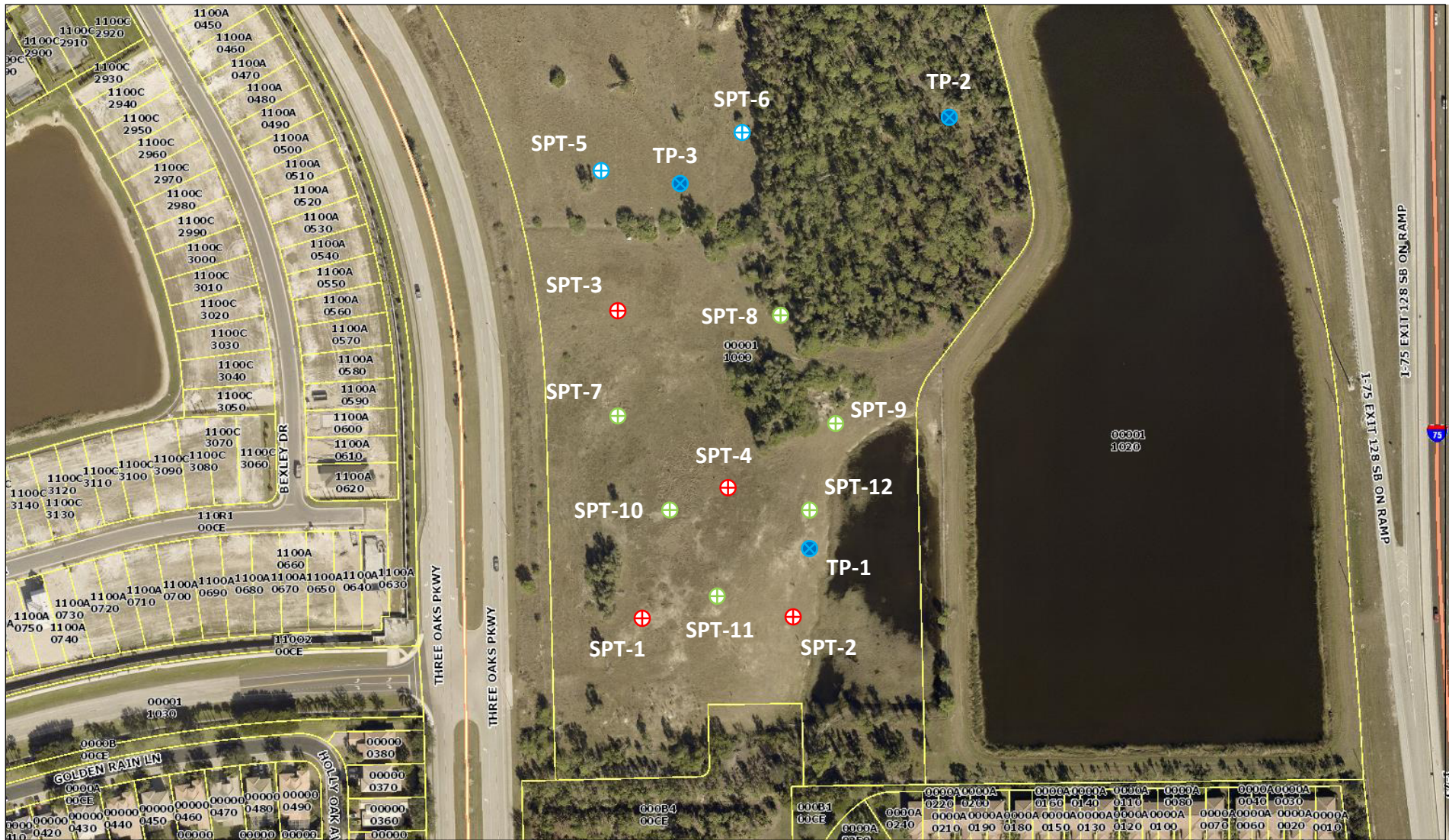


FIGURE 1 **SITE LOCATION MAP**

SOURCE: GOOGLE EARTH PRO

 Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants		
Proposed Multi-Family Residential Development South Part of Alico Interchange Park SWC of I-75 and Alico Road Estero, Lee County, FL		
Drawn By: ME	Checked By: GD	Date: 6/15/18
File No.: 18-33-4520	Approved By: Gary Drew, P.E.	Figure No: 1



⊕ = 35' SPT Borings

⊕ = 30' SPT Borings

⊕ = 20' SPT Borings

⊗ = Test Pits

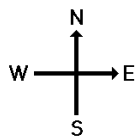


FIGURE 2 TEST LOCATION PLAN

SOURCE: LEEPA.ORG

Ardaman & Associates, Inc.
Geotechnical, Environmental
and Materials Consultants

Proposed Multi-Family Residential Development
South Part of Alico Interchange Park
SWC of I-75 and Alico Road
Estero, Lee County, FL

Drawn By: ME	Checked By: GD	Date: 6/15/18

File No.: 18-33-4520	Approved By: Gary Drew, P.E.	Figure No: 2

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'169"**LONGITUDE:** W 81°47'888"**DATE DRILLED:** 18-APR-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 4.0'**DATE:** 18-APR-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS **LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	11-7-9	16	1		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).	15' OF HW CASING INSTALLED					
	9-10-10	20	2									
	12-14-16	30	3									
5	8-9-8	17	4									
	4-2-1	3	5					18.9	12.1			
	3-4-14	18	6		SP	Poorly Graded Sand - Brown fine sand.						
10	11-7-8	15	7		SC-SM	Silty Clayey Sand - Brown silty clayey fine sand.						
					SM	Silty Sand - Brown silty fine sand, trace to some gravel (rock fragments).						
15	4-4-2	6	8									
					SP-SM	Poorly Graded Sand with Silt and Gravel - Gray partially cemented slightly silty medium to fine sand, some gravel (rock fragments and cemented sands).						
20	1-0-2	2	9									
					SP	Poorly Graded Sand - Brown fine sand.						
25	2-1-1	2	10									
					SM	Silty Sand - Light brown silty fine sand, trace gravel (rock fragments).						
30	4-6-8	14	11									
					SC	Clayey Sand - Gray clayey fine sand.						
35	3-2-3	5	12			TERMINATED AT 35.5'						

**Ardaman & Associates, Inc.**Geotechnical, Environmental and
Materials Consultants

PAGE 1 OF 1

REVIEWED BY:

GARY A. DREW, P.E.

FILE NO:

18-33-4520

BORING NO.:

SPT-1

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°29'168" LONGITUDE: W 81°47'859" DATE DRILLED: 20-APR-18 START: FINISH: GROUND SURFACE ELEVATION: TIME: WATER TABLE DEPTH (ft): 4.0' DATE: 20-APR-18	CLIENT: COURTELIS COMPANY PROJECT: PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT LOCATION: ALICO INTERCHANGE PARK DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57/AUTO	BIT: 2-15/16" DIA. TRI CONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID		WEATHER CONDITIONS: SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	14- 8- 9	17	1		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).	15' OF HW CASING INSTALLED					
	7- 6- 6	12	2									
	4- 6- 4	10	3									
5	3- 3- 4	7	4									
	5- 9- 17	26	5		SP	Poorly Graded Sand - Brown fine sand.						
	12- 14- 21	35	6									
10	13- 13- 11	24	7		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
							Loss of drilling fluid circulation at 11.5'					
					SM	Silty Sand - Light brown silty fine sand, trace to some gravel (rock fragments).						
15	1- 1- 0	1	8									
					SP-SM	Poorly Graded Sand with Silt - Gray partially cemented slightly silty medium to fine sand, trace to some gravel (rock fragments and cemented sands).						
20	7- 7- 10	17	9									
					SM	Silty Sand - Gray partially cemented silty medium to fine sand, trace to some gravel (rock fragments and cemented sands).		26.7	26.1			
25	4- 3- 4	7	10									
					SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
30	3- 2- 1	3	11									
					SC-SM	Silty Clayey Sand - Gray silty clayey fine sand.						
35	6- 6- 5	11	12			TERMINATED AT 35.5'						

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'252"**LONGITUDE:** W 81°47'890"**DATE DRILLED:** 18-APR-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 4.5'**DATE:** 18-APR-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE, E.I.**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	2-4-5	9	1		SP	Poorly Graded Sand - Brown fine sand.	15' OF HW CASING INSTALLED					
	4-6-7	13	2									
	4-3-4	7	3									
5	3-3-3	6	4									
	2-1-0	1	5		SM	Silty Sand - Brown silty fine sand.						
	1-1-3	4	6			Soft Weathered Limestone						
10	1-1-2	3	7									
					SM	Silty Sand - Gray partially cemented silty medium to fine sand, trace to some gravel (rock fragments and cemented sands).						
15	20-14-9	23	8					28.1	25.2			
20	4-2-1	3	9									
25	3-1-1	2	10									
					SC-SM	Silty Clayey Sand - Gray silty clayey fine sand.						
30	2-1-1	2	11									
					CL	Sandy Lean Clay - Greenish gray sandy lean clay.						
35	9-14-13	27	12			TERMINATED AT 35.5'						

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PAGE 1 OF 1

REVIEWED BY:

GARY A. DREW, P.E.

FILE NO:

18-33-4520

BORING NO.:

SPT-3

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'198"**LONGITUDE:** W 81°47'871"**DATE DRILLED:** 20-APR-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 4.0'**DATE:** 20-APR-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE, E.I.**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	27- 15- 18	33	1		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).	15' OF HW CASING INSTALLED					
	14- 11- 11	22	2									
	11- 9- 10	19	3		SC-SM	Silty Clayey Sand - Brown silty clayey fine sand.		15.2	24.1			
5	8- 7- 6	13	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3- 4- 9	13	5									
	14- 50-	50/3"	6		SM	Silty Sand - Brown silty fine sand.						
10	50/0" - -	50/0"				Hard Limestone						
							Loss of drilling fluid circulation at 12'					
15	50/2" - -	50/2"										
20	4- 6- 6	12	7		SP-SM	Poorly Graded Sand with Silt and Gravel - Gray partially cemented slightly silty medium to fine sand, some gravel (rock fragments and cemented sands).						
25	9- 7- 8	15	8		SM	Silty Sand - Gray partially cemented silty medium to fine sand, trace to some gravel (rock fragments and cemented sands).						
30	3- 4- 7	11	9									
35	4- 2- 3	5	10									
						TERMINATED AT 35.5'						



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PAGE 1 OF 1

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GARY A. DREW, P.E.

FILE NO:

18-33-4520

BORING NO.:

SPT-4

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'200"**LONGITUDE:** W 81°47'972"**DATE DRILLED:** 20-APR-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 5.0'**DATE:** 20-APR-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE, E.I.**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	1- 2- 2	4	1		SP	Poorly Graded Sand - Gray to brown fine sand.	15' OF HW CASING INSTALLED					
	2- 3- 4	7	2									
	3- 4- 6	10	3									
5	4- 4- 5	9	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		16.6	8.7			
	5- 5- 6	11	5									
	5- 4- 2	6	6					15.9	11.9			
10	1- 10- 3	13	7		SC-SM	Silty Clayey Sand - Brown silty clayey fine sand.						
						Weathered Limestone						
					SP-SM	Poorly Graded Sand with Silt and Gravel - Brown slightly silty fine sand, some gravel (rock fragments).	Loss of drilling fluid circulation at 12'					
15	1- 3- 3	6	8									
					SM	Silty Sand - Gray partially cemented silty medium to fine sand, trace to some gravel (rock fragments and cemented sands).						
20	8- 4- 5	9	9									
						TERMINATED AT 20.5'						
25												
30												
35												



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REVIEWED BY:

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FILE NO:

18-33-4520

BORING NO.:

SPT-5

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'290"**LONGITUDE:** W 81°47'859"**DATE DRILLED:** 20-APR-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 5.0'**DATE:** 20-APR-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	1- 1- 2	3	1		SP	Poorly Graded Sand - Gray to brown fine sand.	15' OF HW CASING INSTALLED					
	4- 6- 7	13	2									
	4- 3- 3	6	3									
5	4- 2- 1	3	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	2- 1- 1	2	5									
	1- 1- 0	1	6					23.0	11.8			
10	1- 0- 0	0	7		SC-SM	Silty Clayey Sand - Brown silty clayey fine sand.						
							Loss of drilling fluid circulation at 11.5'					
					SM	Silty Sand - Gray partially cemented silty medium to fine sand, trace to some gravel (rock fragments and cemented sands).						
15	5- 10- 10	20	8									
20	3- 2- 1	3	9									
						TERMINATED AT 20.5'						
25												
30												
35												



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REVIEWED BY:

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FILE NO:

18-33-4520

BORING NO.:

SPT-6

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'13.23"**LONGITUDE:** W 81°47'53.51"**DATE DRILLED:** 6-JUN-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 6.0'**DATE:** 6-JUN-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS **LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	3-3-4	7	1		SP	Poorly Graded Sand, Light brown fine sand.	15' OF HW CASING INSTALLED					
	5-5-6	11	2									
	4-4-5	9	3									
5	3-2-2	4	4									
	2-1-1	2	5									
	1-3-7	10	6									
10	4-6-6	12	7									
					SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).						
15	4-7-11	18	8									
					SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand, trace gravel (rock and shell fragments).						
20	8-20-16	36	9									
					ML	Sandy Silt - Gray sandy silt.						
25	3-7-6	13	10									
30	1-0-1	1	11									
						TERMINATED AT 30.5'						
35												

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PAGE 1 OF 1

REVIEWED BY:

GARY A. DREW, P.E.

FILE NO:

18-33-4520

BORING NO.:

SPT-7

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'14.76"**LONGITUDE:** W 81°47'50.94"**DATE DRILLED:** 6-JUN-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 5.0'**DATE:** 6-JUN-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	3-2-4	6	1		SP	Poorly Graded Sand, Light brown fine sand.	15' OF HW CASING INSTALLED					
	5-6-5	11	2									
	5-8-6	14	3									
5	6-5-6	11	4									
	4-3-2	7	5		SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand, trace gravel (rock fragments).						
	7-9-8	17	6									
10	17-37-47	84	7			Hard Limestone.						
					SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).						
15	13-9-6	15	8									
					SM	Silty Sand - Gray silty fine sand, trace gravel (rock and shell fragments).						
20	1-0-0	0	9									
					SM	Silty Sand - Gray silty fine sand, trace gravel (rock and shell fragments).						
25	4-3-4	7	10									
					SM	Silty Sand - Gray silty fine sand, trace gravel (rock and shell fragments).						
30	1-1-2	3	11		ML	Sandy Silt - Gray sandy silt.						
						TERMINATED AT 30.5'						
35												

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REVIEWED BY:

GARY A. DREW, P.E.

FILE NO:

18-33-4520

BORING NO.:

SPT-8

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'13.23"**LONGITUDE:** W 81°47'50.04"**DATE DRILLED:** 7-JUN-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):****DATE:** 7-JUN-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	9-39-42	81	1		SM	Silty Sand - Gray to brown slightly silty fine sand, trace to some gravel (rock fragments).	15' OF HW CASING INSTALLED					
	40-18-10	28	2					8.3	16			
	12-9-9	18	3									
5	4-4-4	8	4									
	4-7-8	15	5		SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand, trace gravel (rock fragments).						
	5-6-6	12	6									
10	4-2-2	4	7									
15	5-1-2	3	8		SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).						
						Hard Limestone.						
20	1-0-0	0	9		SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).						
25	2-1-1	2	10		SM	Silty Sand - Gray silty fine sand, trace gravel (rock and shell fragments).						
30	1-1-2	3	11		ML	Sandy Silt - Gray sandy silt.						
						TERMINATED AT 30.5'						
35												



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REVIEWED BY:

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FILE NO:

18-33-4520

BORING NO.:

SPT-9

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'11.87"**LONGITUDE:** W 81°47'52.83"**DATE DRILLED:** 7-JUN-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 7.0'**DATE:** 7-JUN-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	2-4-9	13	1		SM	Silty Sand - Gray to brown slightly silty fine sand, trace to some gravel (rock fragments).	15' OF HW CASING INSTALLED					
	12-17-14	31	2									
	10-10-12	22	3									
5	13-11-10	21	4									
	7-7-8	15	5					11	13			
	4-3-3	6	6									
10	3-10-50	60	7			Hard Limestone.						
						Soft Weathered Limestone.						
15	4-7-4	11	8		SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).	Loss of drilling fluid circulation at 15'					
20	7-5-4	9	9									
					SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand, trace gravel (rock fragments).						
25	8-7-6	13	10									
					ML	Sandy Silt - Gray sandy silt.						
30	3-2-2	4	11									
						TERMINATED AT 30.5'						
35												

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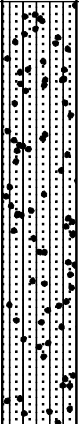
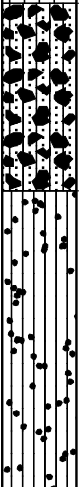
FILE NO:

18-33-4520

BORING NO.:

SPT-10

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'10.66"**LONGITUDE:** W 81°47'51.86"**DATE DRILLED:** 7-JUN-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 7.0'**DATE:** 7-JUN-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	5- 7- 10	17	1		SM	Silty Sand - Gray to brown slightly silty fine sand, trace to some gravel (rock fragments).	15' OF HW CASING INSTALLED					
	8- 8- 7	15	2									
	8- 8- 10	18	3									
5	15- 11- 10	21	4									
	14- 11- 9	20	5									
	8- 9- 12	21	6									
10	4- 7- 5	12	7									
					SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).						
15	3- 4- 3	7	8									
						Hard Limestone.	Loss of drilling fluid circulation at 16.5'					
					SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).						
20	5- 4- 8	12	9									
					ML	Sandy Silt - Gray sandy silt, trace gravel (shell fragments).						
25	4- 1- 1	2	10									
30	1- 0- 1	1	11									
						TERMINATED AT 30.5'						
35												

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REVIEWED BY:

GARY A. DREW, P.E.

FILE NO.:

18-33-4520

BORING NO.:

SPT-11

BORING LOCATION: SEE BORING LOCATION PLAN**LATITUDE:** N 26°29'11.87"**LONGITUDE:** W 81°47'50.40"**DATE DRILLED:** 7-JUN-18**START:****FINISH:****GROUND SURFACE ELEVATION:****TIME:****WATER TABLE DEPTH (ft):** 4.0'**DATE:** 7-JUN-18**CLIENT:** COURTELIS COMPANY**PROJECT:** PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT**LOCATION:** ALICO INTERCHANGE PARK**DRILL CREW:** LOCKLEY / BENAVIDES / SKEWIS**LOGGED BY:** M. ELMORE,**DRILL MAKE & MODEL:** MOBILE B-57/AUTO**BIT:** 2-15/16" DIA. TRI CONE ROLLER**DRILLING RODS:** AW**DRILLING METHOD:** ROTARY WASH WITH DRILLING FLUID**WEATHER CONDITIONS:** SUNNY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	7- 5- 3	8	1		SM	Silty Sand - Gray to brown slightly silty fine sand, trace to some gravel (rock fragments).	15' OF HW CASING INSTALLED	15	17			
	2- 1- 1	2	2		SM							
	2- 1- 2	3	3		SM							
5	1- 0- 1	1	4		SM							
	1- 0- 2	2	5		SM							
	7- 5- 6	11	6		SM							
10	14- 7- 10	17	7		SM	Silty Sand - Gray silty fine sand, trace gravel (rock and shell fragments).						
					SM	Silty Sand with Gravel - Gray partially cemented silty medium to fine sand, some gravel (rock fragments and cemented sands).						
15	12- 7- 4	11	8		SM							
20	1- 3- 1	4	9		SM							
					SM	Silty Sand - Gray silty fine sand, trace gravel (rock and shell fragments).						
25	3- 2- 2	4	10		SM							
					ML	Sandy Silt - Gray sandy silt.						
30	1- 1- 1	2	11			TERMINATED AT 30.5'						
35												

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REVIEWED BY:

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FILE NO:

18-33-4520

BORING NO.:

SPT-12

TEST PIT LOGS

Test Pit No. 1 (TP-1)		Water Table Depth (ft): 6'	Date: 10-MAY-18			
<u>Depth</u>						
<u>From</u>	<u>To</u>	<u>Soil/Rock Description</u>	<u>NM</u>	<u>-200</u>	<u>LL</u>	<u>PI</u>
0	4'	Brown slightly silty fine sands with gravel and boulders (SP-SM)				
4'	5.5'	Brown and gray silty fine sands, with gravel and boulders (SM)	8.8	20.1		
5.5'	6.5'	Brown and gray silty clayey fine sands (SC-SM)				
6.5'	TERM. (6.5') Weathered Limestone					

Test Pit No. 2 (TP-2)		Water Table Depth (ft): 7'	Date: 10-MAY-17			
<u>Depth</u>						
<u>From</u>	<u>To</u>	<u>Soil/Rock Description</u>	<u>NM</u>	<u>-200</u>	<u>LL</u>	<u>PI</u>
0	4.5'	Gray to brown fine sands (SP)				
4.5'	8'	Brown slightly silty fine sands (SP-SM)	20.8	9.0		
8'	10'	Brown and gray silty fine sands (SM)	22.7	32.1	NP	NP
10'	12'	Weathered Limestone				
12'	TERM. (17') Brown and gray slightly silty fine sands (SP-SM) with Interbedded clayey fine sands layers (SC)					

Test Pit No. 3 (TP-3)		Water Table Depth (ft): 9'	Date: 10-MAY-17			
<u>Depth</u>						
<u>From</u>	<u>To</u>	<u>Soil/Rock Description</u>	<u>NM</u>	<u>-200</u>	<u>LL</u>	<u>PI</u>
0	4'	Gray to brown fine sands (SP)				
4'	9'	Brown slightly silty fine sands (SP-SM)				
9'	12'	Gray silty clayey fine sands (SC-SM)	16.1	31.3	23	7
12'	14'	Weathered Limestone				
14'	16'	Gray clayey fine sands (SC)				
16'	TERM. (17') Brown and gray silty clayey fine sands (SC-SM)					



APPENDIX

- **SOIL BORING, SAMPLING AND TESTING METHODS
PROJECT SOIL DESCRIPTION PROCEDURE – UNIFIED**

SOIL BORING, SAMPLING AND TESTING METHODS

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2-foot (0.6 m) long, 2-inch (50 mm) O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches (0.45 m) into the ground by successive blows of a 140-pound (63.5 Kg) hammer freely dropping 30 inches (0.76 m). The number of blows needed for each 6 inches (0.15 m) of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch (0.15 m) increments penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Q_u):

Cohesionless Soils:		N-Value	N-Value	Description	Relative Density
		Safety Hammer	Auto Hammer		
		< 4	< 3	Very loose	0 - 15%
		4 - 10	3 - 8	Loose	15 - 35%
		10 - 30	8 - 24	Medium dense	35 - 65%
		30 - 50	24 - 40	Dense	65 - 85%
		> 50	> 40	Very dense	85 - 100%

Cohesive Soils:		N-Value	N-Value	Description	Unconfined Compressive Strength, Q_u
		Safety Hammer	Auto Hammer		
		< 2	< 1	Very soft	< 0.25 tsf (25 kPa)
		2 - 4	1 - 3	Soft	0.25 - 0.50 tsf (25 - 50 kPa)
		4 - 8	3 - 6	Firm	0.50 - 1.0 tsf (50 - 100 kPa)
		8 - 15	6 - 12	Stiff	1.0 - 2.0 tsf (100 - 200 kPa)
		15 - 30	12 - 24	Very stiff	2.0 - 4.0 tsf (200 - 400 kPa)
		> 30	> 24	Hard	> 4.0 tsf (400 kPa)

The tests are usually performed at 5-foot (1.5 m) intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling with neat cement.

Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangements have been made.

POWER AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4-inch (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5-foot (1.5 m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is described and representative samples put in bags or jars and returned to the laboratory for classification and testing, if necessary.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5-foot [1.5 m]) depth or when access is not available to power drilling equipment. A 3-inch (75 mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6-inch (0.15 m) intervals and its contents emptied for inspection. Sometimes post-hole diggers are used, especially in the upper 3 feet (1 m) or so. The soil sample obtained is described and representative samples put in bags or jars and transported to the laboratory for classification and testing, if necessary.

UNDISTURBED SAMPLING

Undisturbed sampling implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of in-situ conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized for most geotechnical engineering purposes. Testing of undisturbed samples gives a more accurate estimate of in-situ behavior than is possible with disturbed samples.

Normally, we obtain undisturbed samples by pushing a 2.875-inch (73 mm) I.D., thin wall seamless steel tube 24 inches (0.6 m) into the soil with a single stroke of a hydraulic ram. The sampler, which is a Shelby tube, is 30 (0.8 m) inches long. After the sampler is retrieved, the ends are sealed in the field and it is transported to our laboratory for visual description and testing, as needed. Undisturbed sampling is noted on the boring logs as thus "U-".

LABORATORY TEST METHODS

Soil samples returned to our laboratory are looked at again by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain-size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report, the results of which will be located in an Appendix. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures. Following is a list of abbreviations that may appear in the Remarks column on the boring logs indicating additional laboratory testing was performed, the results of which will usually be located in an Appendix.

DD:	Unit Weight/Classification of Undisturbed "Shelby Tube" samples
PP:	Pocket Penetrometer reading on cohesive samples in tons per sq. ft. (tsf)
k:	Hydraulic Conductivity
Qu:	Unconfined Compression Strength; ASTM D-2166
UU:	Unconsolidated-Undrained Triaxial Test; ASTM D 2850
Consol:	One-Dimensional Consolidation test performed on subsample from undisturbed sample; ASTM D-2435

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

BOULDERS (>12" [300 mm]) and COBBLES (3" [75 mm] TO 12" [300 mm]):

GRAVEL: Coarse Gravel: 3/4" (19 mm) to 3" (75 mm)
Fine Gravel: No. 4 (4.75 mm) Sieve to 3/4" (19 mm)

Descriptive adjectives:

0 – 5%	---	no mention of gravel in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	gravelly (shell, limerock, cemented sands)

SANDS

COARSE SAND: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
MEDIUM SAND: No. 40 (425 μ m) Sieve to No. 10 (2 mm) Sieve
FINE SAND: No. 200 (75 μ m) Sieve to No. 40 (425 μ m) Sieve

Descriptive adjectives:

0 – 5%	---	no mention of sand in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	sandy

SILT/CLAY: < #200 (75 μ m) sieve

SILTY OR SILT: $PI < 4$
SILTY CLAYEY OR SILTY CLAY: $4 \leq PI \leq 7$
CLAYEY OR CLAY: $PI > 7$

Descriptive adjectives:

0 – 5%	---	clean (no mention of silt or clay in description)
5 – 12% to 15%	---	slightly
16 – 35%	---	clayey, silty, or silty clayey
36 – 49%	---	very

ORGANIC SOILS

<u>Organic Content</u>	<u>Descriptive adjectives</u>	<u>Classification</u>
0 – 2.5%	no mention of organics in description	See above
2.6 – 5%	slightly organic	See above
5 – 20%	organic	Add "with organic fines" to group name

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

HIGHLY ORGANIC SOILS AND MATTER

<u>Organic Content</u>	<u>Description</u>	<u>Classification</u>
20-75%	highly organic sand or muck sandy peat	Peat (PT) Peat (PT)
>75%	amorphous or fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE

<u>Descriptive Term</u>	<u>Thickness</u>
with interbedded	
seam:	less than 1/2-inch (13 mm) thick
layer:	1/2 to 12-inches (13 to 300 mm) thick
stratum:	more than 12-inches (300 mm) thick
pocket:	small, erratic deposit, usually less than 1-foot
occasional:	one or less per foot of thickness
frequent:	more than one per foot of thickness
calcareous:	containing calcium carbonate (reaction to diluted HCL)
hardpan:	spodic horizon usually medium dense
marl:	mixture of carbonate clays, silts, shells and sands.

ROCK CLASSIFICATION

<u>Description</u>
Hard Limestone or Caprock – N-values >50 bpf
Soft Weathered Limestone – N values <50 bpf

(1) This soil description procedure was developed specifically for projects in southwest Florida because it is believed that the terminology will be better understood as a result of local practice. It is not intended to supplant other visual-manual classification procedures for description and identification of soils such as ASTM D 2488. BY: G.A. DREW, P.E. (1995) (Revised 2016).

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification		
				Group Symbol	Group Name ^B	
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F	
			$Cu < 4$ and/or $1 > Cc > 3$ ^E	GP	Poorly graded gravel ^F	
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F,G,H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F,G,H}	
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I	
			$Cu < 6$ and/or $1 > Cc > 3$ ^E	SP	Poorly graded sand ^I	
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G,H,I}	
			Fines classify as CL or CH	SC	Clayey sand ^{G,H,I}	
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}	
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}	
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried		Organic silt ^{K,L,M,O}	
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}	
			PI plots below "A" line	MH	Elastic Silt ^{K,L,M}	
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}
			Liquid limit - not dried		Organic silt ^{K,L,M,Q}	
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat	

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles" or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

