Wold Architects and Engineers
220 North Smith Street, Suite 310
Palatine, IL 60067
woldae.com | 847 241 6100

Project Manual

Village Hall Addition and Remodel

VILLAGE OF LONG GROVE

LONG GROVE, IL
November 20, 2023

99% Bid Set

Set No: _____

Comm No: 233052

SECTION 00 01 01
PROJECT TITLE PAGE

P R O J E C T M A N U A L

PROJECT IDENTIFICATION

BIDDING REQUIREMENTS

CONDITIONS OF THE CONTRACT

GENERAL REQUIREMENTS

AND SPECIFICATIONS

FOR

Village of Long Grove - Village Hall Addition and Remodel
3110 Old McHenry Road
Long Grove, Illinois 60047

Village of Long Grove
3110 Old McHenry Road
Long Grove, Illinois 60047

BID TIME: TBD

BID DATE: TBD

BID PLACE:
Village of Long Grove Village Hall
3110 Old McHenry Road
Long Grove, Illinois 60047

ISSUE DATE: November 27, 2023

END OF SECTION 00 01 01

SECTION 00 01 03
PROJECT DIRECTORY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification of project team members and their contact information.

1.02 OWNER:

A. Name: Village of Long Grove
   1. Address: 3110 Old McHenry Road, Long Grove, Illinois 60047

1.03 CONSULTANTS:

A. Architect:
   1. Company Name: Wold Architects and Engineers
      a. Address: 332 Minnesota Street, Suite W2000, St. Paul, Minnesota 55101
      b. Telephone: (651) 227-7773

B. Civil Engineering Consultant:
   1. Company Name: Gewalt Hamilton and Associates, Inc.
      a. Address: 625 Forest Edge, Vernon Hills, Illinois 60061
      b. Telephone: 847-478-9700

C. Structural Engineering Consultant:
   1. Company Name: Johnson Wilbur Adams, Inc.
      a. Address: 330 Napervile Road, Suite #300, Wheaton, Illinois 60187
      b. Telephone: 630-653-9060

D. Mechanical Engineering Consultant:
   1. Company Name: Wold Architects and Engineers
      a. Address: 220 North Smith Street, Suite 310, Palatine, Illinois 60067
      b. Telephone: 847-241-6100

E. Electrical Engineering Consultant:
   1. Company Name: TLC Engineering Solutions
      a. Address: 1301 West, W22nd Street, Suite 210, Oak Brook, Illinois 60523
      b. Telephone: 630-472-0918

END OF SECTION 00 01 03

SECTION 00 01 05
CERTIFICATIONS PAGE
Village of Long Grove - Village Hall Addition and Remodel
Village of Long Grove

Architect: Wold Architects and Engineers

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Architect under the laws of the State of Illinois.

Signature: _____
Typed Name: Matt Bickel
Registration: 1020883
Date Signed: November 27, 2023

Civil Engineer: Gewalt Hamilton and Associates, Inc.

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

Signature: _____
Typed Name: Geoff Perry
Registration: _____
Date Signed: November 27, 2023

Structural Engineer: Johnson Wilbur Adams

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

Signature: _____
Typed Name: Kent Adams
Registration: 081-005394
Date Signed: November 27, 2023

Mechanical Engineer: Wold Architects and Engineers

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

Signature: _____
Typed Name: Matt Verdun
Registration: 062-059546
Date Signed: November 27, 2023

Electrical Engineer: TLC Engineering Solutions

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

Signature: _____
Typed Name: David McVey
Registration: 062-048431
Date Signed: November 27, 2023

END OF SECTION 00 01 05

SECTION 00 01 10

TABLE OF CONTENTS

END OF SECTION 00 01 10

SECTION 00 11 13
ADVERTISEMENT FOR BIDS
Village of Long Grove - Village Hall Addition and Remodel
3110 Old McHenry Road
Long Grove, Illinois 60047

Village of Long Grove will receive single prime sealed bids for Village of Long Grove - Village Hall Addition and Remodel until TBD local time on TBD at the Village of Long Grove Village Hall, 3110 Old McHenry Road, Long Grove, Illinois60047, at which time and place all bids will be publicly opened and read aloud.

Bidding documents, including the Proposal Form, Drawings and Specifications, will be on file at the Minnesota Builders Exchange; McGraw Hill Construction/Dodge Plan Center; Reed Construction; iSqFt Plan Room (St. Paul, MN), The Blue Book Building and Construction Network; and from PlanWell at https://order.e-arc.com/arcEOC/Secures/PWELL_PrivateList.aspx?PrjType=pub

Franz Reprographics at www.franzrepro.com

Albert Lea Builders Exchange; Austin Builders Exchange; Duluth Builders Exchange; Hibbing Plan Room; Mankato Builders Exchange; Builders Exchange of Rochester; Southwest Builders Exchange (Marshall, MN); Mid Minnesota Builders Exchange (Willmar, MN); Northwest Regional Builders Exchange (Eau Claire); Fargo-Moorhead Builders Exchange; Grand Forks Builders Exchange; Sioux Falls Builders Exchange; LaCrosse Builders Exchange.

This project includes: _____

American Reprographics Company, 4730 Park Glen Road, St. Louis Park, Minnesota 55416 (952) 697-8800, facsimile (952) 697-8803 will provide complete downloadable sets of the Bidding Documents to prospective bidders and subcontractors. The downloads will be available November 27, 2023. A deposit check in the amount of $25 made out to ARC for each set downloaded via the internet at https://www.e-arc.com/location/st-louis-park/ and clicking on the PlanWell icon, then the Public Plan Room icon, select Village of Long Grove - Village Hall Addition and Remodel. American Reprographics Company, 4730 Park Glen Road, St. Louis Park, Minnesota 55416 (952) 697-8800, facsimile (952) 697-8803, will provide complete sets of the Bidding Documents to prospective bidders and subcontractors. The copies will be available about November 27, 2023. Both a deposit check in the amount of $D COST and a non-refundable check in the amount of $P COST made out to "Village of Long Grove" for each set ordered are required or Bidding Documents may be ordered via the internet at https://www.e-arc.com/location/st-louis-park/. and clicking on the PlanWell icon, then the Public Plan Room icon, select Village of Long Grove - Village Hall Addition and Remodel. The following information must accompany the deposit: Company name, mailing address, street address, phone and facsimile numbers and type of bidder (i.e. General, Mechanical or Electrical Subcontractor to General, or other). A refund of $D COST will be sent to prime contractors who submit a bid to the Owner and subcontractors for each set (including addenda) returned to American Reprographics Company in good condition within ten (10) calendar days of the award date, subject to the conditions of AIA Document A701. Refunds will not be given if the plans are returned to the Architect's Office.
Bidders may obtain drawings and specifications for the project from Franz Reprographics (Phone: 763-503-3401) at the following location: http://www.franzrepro.com. Follow link to 'Franz Plan Room' for ability to download, order and view plans and specifications. This link will also provide locations of Builders Exchanges holding plans for contractors to access.

Make proposals on the bid forms supplied in the Project Manual. No oral, telegraphic or telephonic proposals or modifications will be considered. Submit with each bid, a certified check or acceptable bidder's bond payable to Village of Long Grove in an amount equal to five percent (5%) of the total bid. The successful bidder will be required to furnish satisfactory Labor and Material Payment Bond, and Performance Bond.

Bids may not be withdrawn within thirty (30) days after the scheduled time of opening bids, without the consent of the Owner. The Owner reserves the right to accept any bid or to reject any or all bids, or parts of such bids, and waive informalities or irregularities in bidding.

The Owner requires Substantial Completion of the project on or before January 2025.

Village Board
Village of Long Grove

END OF SECTION 00 11 13

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

The Instructions to Bidders, AIA Document A701, 2018 is attached after this section.

END OF SECTION 00 21 13

SECTION 00 31 32
GEOTECHNICAL DATA
VILLAGE OF LONG GROVE - VILLAGE HALL ADDITION AND REMODEL

END OF SECTION 00 31 32

SECTION 00 41 00
BID FORM

TURN OFF SPECIFIER NOTES

THE PROJECT AND THE PARTIES

1.01 TO:

A. Village of Long Grove
Village of Long Grove Village Hall
3110 Old McHenry Road
Long Grove, Illinois 60047

1.02 FOR:

A. Project: Village of Long Grove - Village Hall Addition and Remodel

B. Project Number: 233052
3110 Old McHenry Road
Long Grove, Illinois 60047

We have examined the Contract Documents for the proposed Village of Long Grove - Village Hall Addition and Remodel as prepared by Wold Architects and Engineers, St. Paul, Minnesota, and the conditions affecting the work.

1.03 DATE: _____ (BIDDER TO ENTER DATE)

1.04 SUBMITTED BY: (BIDDER TO ENTER NAME AND ADDRESS)

A. Bidder's Full Name _____
1. Address _____
2. City, State, Zip_____
3. Telephone Number (___)_____
4. Fax Number (___)_____

1.05 ACCEPTANCE

A. Accompanying this proposal is a Bid Security for all work, required to be furnished by Contract Documents, the same being subject to forfeiture in the event of default by the undersigned.

B. I agree to complete the Project, provided a contract is executed within 30 calendar days, by January 2025.

C. I understand the Owner reserves the right to reject any or all bids, and it is agreed that this bid may not be withdrawn for a period of thirty (30) days from the opening thereof.

D. ***SPECIFIER NOTE: KEEP BELOW FOR <u>WISCONSIN</u> PROJECTS ONLY***

E. My bid includes value for Owner Purchased Materials as defined in Section 01 11 19. I understand a deduct change order will be processed after award of the contract for the value of Owner purchased materials.

1.06 BASE BID

A. The Bidder agrees to perform all work including General, Mechanical and Electrical Construction for the Base Bid Sum of:
_____ Dollars $_____

1.07 ALTERNATES

A. The Bidder agrees to add to or deduct from the Base Bid Sum the following amounts to perform the alternate work described in Section 01 23 00 - Alternates, including all associated costs.
1. Alternate No. 1 _____
Add/Deduct _____ Dollars $_____
2. Alternate No. 2 _____
Add/Deduct _____ Dollars $_____
3. Alternate No. 3 _____
Add/Deduct _____ Dollars $_____

1.08 UNIT PRICES

A. The following are Unit Prices for specific portions of the Work as listed. The following is the list of Unit Prices:
ITEM DESCRIPTION - UNIT QUANTITY - UNIT PRICE - ITEM VALUE
_____ - _____ - _____ - $ .....
_____ - _____ - _____ - $ .....
_____ - _____ - _____ - $ .....

_____ - _____ - _____ - $ .....

1.09 RESPONSIBLE CONTRACTOR COMPLIANCE

A. By signing this bid form, I am an Owner or Officer of the firm name listed on the bid form and I verify under oath that as a Prime Contractor I am in compliance with the Responsible Contractor criteria as defined in Minnesota Statute 16C.285, subd. 3.

1.10 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum(s) # _____.

1.11 BID FORM SIGNATURE(S)

_____
(Bidder - print the full name of your firm)
was hereunto affixed in the presence of:

_____
(Authorized signing officer, Title)

_____
(Signature)

END OF SECTION 00 41 00

SECTION 00 72 00
GENERAL CONDITIONS

The "General Conditions of the Contract for Construction", AIA Document A201, Sixteenth Edition, 2017 is attached after this section.

END OF SECTION 00 72 00

SECTION 00 73 43
STATE PREVAILING WAGES

STATE OF ILLINOIS DEPARTMENT OF LABOR REQUIREMENTS

This contract constitutes the construction of a "public work", within the meaning of the Illinois Prevailing Wage Act, 820 ILCS 130/.01 et seq. ("the Act"). The Act requires contractors and subcontractors to pay laborers, workers and mechanics performing services on public works projects no less than the "prevailing rate of wages" (hourly cash wages plus fringe benefits) in the county where the work is performed. The Contractor and each subcontractor rendering services under this contract shall comply with all requirements of the Act, including but not limited to, all wage, notice and record keeping duties, and shall include in Bids the cost for compliance with the Act.

a The Illinois Department of Labor Prevailing Wages for location of the project are available at the State of Illinois Data Portal website:
https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Prevailing-Wage-Portal.aspx

b The Contractor and each subcontractor shall inform themselves of current rates and of changes which may be made from time to time. No additional costs shall be incurred by the Owner as a result of changes in the prevailing wage.

c The Contractor and each subcontractor shall comply with all record-keeping requirements of the Illinois Prevailing Wage Act, including, but not limited to, (1) make and keep, for a period of not less than three years, records of all laborers, mechanics, and other workers employed by them on the project; the records shall include each worker's name, address, telephone number when available, social security number, classification or classifications, the hourly wages paid in each pay period, the number of hours worked each day, and the starting and ending times of work each day; and (2) shall submit monthly a certified payroll in conformance with law, and in the form and manner specified by the Contract Documents, or otherwise as acceptable to the Owner.

d The Contractor and each subcontractor shall comply with the Employment of Illinois Workers on Public Works Act (30 ILCS 570). All record keeping requirements are the obligation of the Contractor and Subcontractors.

e The Contractor and each subcontractor shall indemnify and hold harmless both the Owner, Architect, Construction Manager, and their respective officers, employees and agents, from any and all costs incurred, directly or indirectly, by any of them (the Indemnitees) in responding to or complying with demands made by the Illinois Department of Labor, or an aggrieved employee of the Contractor or subcontractor, or any third party, as a result of any claimed violation of or inquiry regarding these Acts. Any such cost incurred by an Indemnitee may be deducted from the Contract Sum. It is the intention that the Indemnitees shall suffer no time loss or expense in complying with any inquiry made with regard to these Acts.

END OF SECTION 00 73 43

SECTION 01 10 00
SUMMARY OF THE WORK

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Village of Long Grove - Village Hall Addition and Remodel
B. Owner's Name: Village of Long Grove
C. Architect's Name: Wold Architects and Engineers.
D. Additional Project contact information is specified in Section 00 01 03 - Project Directory.
E. The Project consists of the construction of an addition(s) of approximately 2,700 SF + remodeling.
F. The Project consists of the construction of _____.
    1. Work under this Contract includes:
        a. Sitework:
            1) Site utilities: Water mains, storm sewers, sanitary sewers.
            2) Rough and finish grading, paving, concrete sidewalks and plazas, ground cover, trees and shrubs.
        b. Building Structure:
            1) Concrete footings, masonry and concrete foundation walls, concrete slabs on grade, insulated wood framed exterior bearing walls.
        c. Building Enclosure:
            1) Exterior wall systems fiber cement board siding and cavity insulation
            2) Aluminum wood composite windows, Wood and steel exterior doors. Galvanized hollow metal doors and frames. Aluminum louvers
            3) Roofing systems wood .
        d. Interior Finishes:
            1) Insulated gypsum board/metal stud partitions, concrete block and burnished concrete block partitions, glazed block partitions.
            2) Floor finishes of carpet, VCT, resilient sheet goods, ceramic tile, porcelain tile, quarry tile, epoxy terrazzo, sand cushion terrazzo, structural terrazzo, epoxy painted and sealed concrete, wood.
            3) Wall finishes of paint, vinyl wallcovering, wall fabric over tackable panels, brick, ceramic tile, porcelain tile, plaster.
            4) Ceiling finishes of acoustical lay-in tile, gypsum board, gypsum board soffits.
            5) Plastic laminate casework, architectural woodwork, wood science casework, HM doors and frames, wood doors, access panels, hardware, glazing, acoustic treatment, lockers, food service equipment, stage equipment, toilet partitions, toilet accessories, markerboards, tackboards, display cases, signage, gymnasium equipment, loading dock equipment, elevator, detention equipment, miscellaneous specialties.
        e. Mechanical Systems:
            1) Plumbing including, supply and waste piping systems, piping insulation, plumbing fixtures, and water heaters.
            2) Heating and Ventilation including piping, ductwork, insulation, furnaces, energy recovery ventilators, and condensing units.
        f. Electrical Systems:
            1) Electrical service, switchgear, distribution panels, conduit and wiring.
            2) Interior and exterior lighting. Parking lot lighting.
            3) Low voltage work to include: _____.
            4) Fire alarm.
G. Keep Architect fully informed about progress of the work, performance of the work and potential problems.

1.02 CONTRACT DESCRIPTION

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.
B. Scope of alterations work is indicated on drawings.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the building during the entire construction period.
B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.
   2. Contractor is to visit site and be familiar with existing conditions. Contractor will be required to accept existing conditions on site prior to mobilizing.
   3. Conform to City's noise control regulations, including limited hours of construction operations.
   4. Do not allow construction waste and debris to accumulate on site; remove debris as it accumulates and, unless specified otherwise, dispose of legally off-site.
   5. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.
B. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Use of site and premises by the public.
C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.
D. Time Restrictions:
   1. The Owner's normal business hours are: 8 am to 4:30 pm.
   2. Should the Contractor begin work within the existing building prior to the scheduled start date, continuous use of facilities is required by the Owner.
      a. Work in those areas shall occur during evenings and weekends and shall be cleaned and available for use the following business day.
   3. Should the Contractor choose to perform work after normal business hours when the building is occupied, the Contractor shall:
      a. Maintain access, building utilities, and services to allow full and free use of the facility during this time. All temporary conditions, re-routing of services, utilities and/or power are the Contractor’s responsibility.
E. Utility Outages and Shutdown:
   1. Provide the Owner with at least 7 days notice of Outages and Shutdowns.
   2. Limit disruption of utility services to hours the building is unoccupied.
   3. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   4. Prevent accidental disruption of utility services to other facilities.

1.06 LAYING OUT WORK

A. Locate all general reference points. Where dimensions or observed scope of work differ substantially from Drawings, notify Architect for decision.
B. Lay out Work from the reference points furnished and be responsible for all lines, elevations, and measurements inside workspace. Exercise proper precaution to verify figures shown on Drawings before laying out work and will be held responsible for any error resulting from his failure to exercise such precaution.
C. Call for public utility locates before starting any excavations.
D. Hire the services of a locator company to locate all privately owned utilities that may be disturbed by construction operations.
E. Coordinate utility connections with municipality/utility company in which project is being constructed.

1.07 WORK SEQUENCE

A. Start submittal process immediately upon contract award by the Owner. Actual work on site shall not commence until a date determined by the Village.
B. Construct Work in phases during the construction period as noted on the Phasing Plans.

1.08 SPECIFICATION SECTIONS APPLICABLE TO EVERY CONTRACT

A. Sections in Division 1 govern the execution of the Work of all items in the Technical Specification Sections.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 10 00

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. **PRODUCT OPTIONS NOT REQUIRING PRE-BID SUBMITTAL**

1. Where a single manufacturer is specified and acceptable manufacturer are also listed, acceptable manufacturers must provide an identical product or accept responsibility for all design implications when providing a product other than the specified product.
2. Where products are specified by reference standards, any product established by a material testing agency to meet these standards is acceptable.
3. Where multiple manufacturers and associated models are specified, select any one named.
4. Where manufacturer(s) alone are specified, select any manufacturer and the product recommended in writing by the manufacturer as most suited to the application shown on the Drawings and Specifications.
5. Where the phrase "or equal" or "equivalent" follows the name of a manufacturer, any product which meets the performance and appearance standards established by the specified manufacturer may be selected, subject to the Architect's acceptance.
6. Where a manufacturer is listed in both a technical specification section and the Interior Material Finish/Color Schedule, on the Drawings and a color is provided.

B. **PRODUCT SUBSTITUTIONS REQUIRING PRE-BID SUBMITTALS**

1. Step One - Manufacturers Substitution Request
   a. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
      1) Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
      2) Agrees to provide the same warranty for the substitution as for the specified product.
      3) Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
      4) Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
      5) Waives claims for additional costs or time extension that may subsequently become apparent.
   b. Attached Substitution Request Form is submitted ten (10) calendar days prior to the bid date with the following information:
      1) Specified manufacturer's model numbers and proposed manufacturer's product literature, noting product numbers for proposed substitutions, and where appropriate, samples and data relating to construction details.
         (a) Clearly indicate on the literature what product is being submitted for substitution.
         (b) If submitted literature does not match the requirements of the specified product, submit a letter stating proposed manufacturer will custom make products to meet specified product.
2. Step Two - Manufacturers Acceptance
   a. Individual specification sections may be amended by the Architect during the bid period to include additional names of manufacturers determined to be capable of providing acceptable materials.
   b. The Interior Material Finish/Color Schedule, on the Drawings or Specifications may be amended by the Architect during the bid period to include colors by manufacturers listed in technical sections, but not noted on the Interior Material Finish/Color Schedule, on the Drawings or in the Specifications.

c. Architect's acceptance is based upon his determination that a manufacturer is capable of supplying acceptable materials. Approval is not assured or implied for a specific material, item of equipment, color or finish.

d. Official notification will be by addendum to the Contract Documents.

1) To propose products when a specific manufacturer's product is specified to comply with a NFPA 285 Wall Assembly, equal products are acceptable as follows:

2) If the proposed equivalent product requires products of other specification sections to be revised to comply with an alternative NFPA 285 Wall Assembly, the substitute manufacturer will pay all associated costs based on changes to products in other specification sections, as well as reimbursement of architectural and engineering services to document those changes, if any, required to incorporate substitution products in the Work.

3. Step Three - Product Acceptance

a. Upon award of a construction contract, accepted manufacturers may submit for review to the Architect through the General Contractor or Construction Manager, specific products, materials or equipment items as substitutes for those specified.

1) Contractor to provide letter stating they will reimburse Architect to review substitutions.

b. Architect will review substitute products for performance, appearance, color, finish, size and suitability for inclusion in the work. If a substitute product is not accepted, submit another product by the same or other accepted manufacturer or provide the specified product.

c. Match specified colors and dimensions exactly, whether or not they are standard with the substitute product, unless a minor variation is accepted by the Architect.

d. If a substitute product is accepted, coordinate any necessary changes in other related work and pay for these changes.

1) Pay cost of architectural or engineering services, if any, required to incorporate substitute products in the Work.

C. **SUBSTITUTIONS BY CHANGE ORDER AFTER CONTRACT AWARD**

1. A substitution for a specified product may be permitted by a no cost or deduct change order to the Owner if product proposed is determined to be equivalent in performance and suitability, and if at least one of the following conditions apply:

a. Owner is given a credit for the work.

b. Product is of superior quality than product specified.

c. Product color or finish selection is preferable.

d. Products specified and upon which building is designed have been discontinued by manufacturer.

2. Provide Architect, through Owner, reasonable compensation for product evaluation.

3.02 ATTACHMENTS

A. A Substitution Request Form required to be used on the Project is included after this section.

END OF SECTION 01 25 00

SECTION 01 25 01
PRE-BID SUBSTITUTION REQUEST FORM

SUBMITTAL TO ARCHITECTS/ENGINEERS OFFICE

To:

Palatine, Illinois
Via: illinois@woldae.com

PROJECT INFORMATION

Project Owner: Village of Long Grove
Project Name: Village of Long Grove - Village Hall Addition and Remodel

PRE-BID SUBMITTAL REQUEST INFORMATION

Date: _____
Specification
Name: _____
Section Number: ____ ____ ____
Paragraph/Article: _____
Proposed Substitution Manufacturer:
Manufacturer Website: www._____._____
Proposed Product
Name: _____
Model: _____

CERTIFICATION

The undersigned/manufacturer certifies they agree with the following:

1. I am the manufacturer or an authorized manufacturer's representative.
2. The proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
3. Literature has been submitted with the product and components clearly indicated. Any items that are different than the specification are noted.
4. Provide the same warranty for the substitution as for the specified product.
5. Provides the same or equivalent maintenance service and source of replacement parts, as applicable.
6. To coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to the Owner.
7. Waives claims for additional costs or time extension that may subsequently become apparent.

Submitted by:
Name printed clearly: _____
Firm: _____
Address:_____
_____
Telephone: _____
Email:_____

END OF SECTION 01 25 01

SECTION 01 26 63
CHANGE ORDERS

PART 1: GENERAL

1.01 CHANGE ORDER PROCEDURES

A. Changes in the Project scope of work affecting the project cost can be made only through AIA Document G701 - Change Order.
   1. The procedures for processing changes in the scope of Work are listed as follows:
   2. The Architect prepares one of the following documents to modify the scope of work. Documents and attachments revising the drawings and specifications will be distributed electronically and the Contractor will be responsible for printing.
      a. Supplemental Instructions (SI) which are used for no cost changes.
      b. Proposal Request (PR) to be used for proposed changes that need written approval on cost prior to proceeding.
      c. Construction Change Directive AIA Document G714 (CCD) which is used when the work must proceed immediately and time and material cost submitted as soon as possible for review by the Architect.
   3. The Contractor reviews and responds as follows:
      a. Supplemental Instructions (SI): This no cost change is to be carried out in accordance with the following modifications to the contract documents described herein. If this change effects cost, do not proceed with this change. Notify the Architect in writing within 10 days of receipt that an itemized (labor and material) quotation will be submitted within 21 days of initial receipt of this Supplemental Instruction. If a cost is not submitted within 21 days, this Supplemental Instruction will be accepted at no additional cost.
      b. Proposal Request (PR): Submit an itemized (labor and material) quotation for the proposed modifications to the contract documents as described herein within 21 days of receipt. If a cost is not submitted within 21 days, this Proposal Request can be accepted at no additional cost. Written approval is required prior to proceeding with this change.
      c. Construction Change Directive AIA Document G714 (CCD): Proceed immediately to carry out this change in the contract documents as described herein. If this revision effects cost, submit an itemized (labor and material) quotation within 21 days of receipt. If a cost is not submitted within 21 days this Change Directive will be accepted at no additional cost.
   4. The Architect will review the Contractor’s labor and material itemized quotation and respond in writing whether it is acceptable or needs revision. When all pricing is accepted by the Architect and Owner, a Change Order will be processed. Change Orders will be processed at increments determined by the Architect throughout the construction schedule.

B. See the General Conditions of the Contract for Construction for methods of determining cost or credit, mark-up and schedule on submitting claims.

END OF SECTION 01 26 63

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Electronic document submittals.
C. Preconstruction meeting.
D. Progress meetings.
E. Schedule of Values.
F. Contractor's daily reports.
G. Progress photographs.
H. Coordination drawings.
I. Submittals for review, information, and project closeout.
J. Requests for Information (RFI) procedures.
K. Submittal procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via email the architect's staff assigned to the project.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. It is Contractor's responsibility to submit documents in allowable format.
   3. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

3.02 LIST OF MATERIALS

A. Within 7 days after the award of the Contract (notice to proceed or letter of intent), submit a complete list electronically of all material, products, and equipment proposed to be used in construction to the Architect for acceptance.
   1. Do not order materials until the proposed listed materials, products and equipment to be used in construction are accepted by the Architect.
B. Where two or more makes or kinds of items are named in the specifications (or additional names are called for in addenda), the Contractor shall state which particular make or kind of each item they proposes to provide. If the Contractor fails to state a preference, the Owner shall have the right to select any of the makes or kinds named without change in price.
C. This list shall be arranged generally in order of specification sections. The items listed shall fully conform to project requirements and specifications. All materials are subject to the Architect's acceptance.
   1. After acceptance, changes or substitutions will not be permitted.
D. Clearly identify or list the material, product or equipment by manufacturer and brand by listing the names for all items, including those where only one material or product is specified. Each and every material, product and equipment shall be specifically named, not listed "as specified".

3.03 LIST OF SUBCONTRACTORS

A. Immediately after Contract award submit a subcontractor and supplier list.
   1. Propose use of subcontractors or sub-subcontractors who are established, reputable firms of recognized standing with a record of successful and satisfactory past performance. Include the following information: specification section, item of work, subcontractor or supplier, material/manufacturer (as specified will not be allowed), project manager, phone and email. List major sub-subcontractors for mechanical and electrical work. Use only those subcontractors (and sub-sub-contractors, when appropriate) who are acceptable to the Architect and Owner on the Work.

3.04 SCHEDULE OF VALUES

A. Requirements
   1. Submit Schedule of Values to Architect ten (10) days prior to first Application For Payment (AIA Form G702, G702a).
      a. For Contracts with multiple buildings, break down Schedule of Values by building.
      b. For projects with multiple phases, break down Schedule of Values by phase.
      c. Break down labor and material separately.
      d. Round off amounts to nearest ten dollars.
   2. Use Schedule of Values only as basis for Contractor's Application For Payment.
B. Form of Submittal
   1. Base format on Sections listed in Section 00 01 10 - Table of Contents, as well as, the Mechanical Electrical, Communications and Security Table of Contents. Break down labor and material separately.

3.05 CONSTRUCTION SCHEDULES

A. Refer to Section 01 32 16 - Construction Progress Schedule.

3.06 PRECONSTRUCTION MEETING

A. Schedule meeting within 15 days after Notice to Proceed.
B. Attendance Required:
   1. Owner's representative.
   2. Architect and their consultants.
   3. Contractor's Project Manager and Site Superintendent.
   4. Major Subcontractors.
   5. Major Suppliers.
   6. Others as appropriate.
C. Agenda:
   1. Distribution and discussion of:
      a. List of subcontractors.
      b. List of major suppliers.
      c. Projected construction schedules.
      d. Submittal schedule.
      e. Scheduling of pre-installation conferences.
   2. Project coordination and scheduling:
      a. Designation of responsible personnel representing the Owner, Contractor, Architect and Architect's Consultants.
      b. Major equipment deliveries and priorites, including expected submittals for such.
      c. Critical work sequencing.
      d. Mock-up Panels.
      e. Temporary utilities.
      f. Use of onsite utilities.
      g. NFPA 285 field coordination meeting to ensure that all materials being proposed align with NFPA 285 test reports. Attendance is mandatory for products being installed by the following contractors:
         1) Spray foam.
         2) Exterior studs.
         3) Exterior sheathing and/or continuous insulation.
         4) Weather barrier.
         5) Cladding materials.
   3. Procedures and processing of: field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
      a. Status of Building Permit and:
         1) Special Inspection Form.
      b. Field decisions.
      c. Submittals.
         1) Mechanical and Electrical Coordination drawings.
      d. Product substitutions.

e. Applications for payments.
f. Time limit on claims of 21 days.
g. Proposal Requests and Supplemental Instructions.
h. Change Orders.
i. Scheduling activities of a Geotechnical Engineer.

4. Procedures for maintaining Record Documents.
5. Use of Premises:
   a. Office, work and storage areas.
   b. Owner's requirements.
6. Construction facilities, controls and construction aids.
   a. Construction Dust Control and Periodic Cleaning:
      1) Submittal of work area and procedures schedule.
      2) Maintaining negative air flow.
      3) Dust control by watermist of surfaces.
      4) Debris removal weekly.
      5) Daily cleaning requirements.
   b. Final Cleaning:
      1) Schedule in time for Owner to complete furniture installation, and cleaning/waxing of floors.
      2) Any cleaning done by the Owner due to unacceptable cleaning by the Contractor, or not proceeding in a timely fashion will be back charged to Contractor.
7. Contractor to record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.07 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at regular intervals and as required due to the progress of the work.
B. Hold called meetings at the Contractor's project field office.
C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect may attend as needed.
   4. Architect' consultants may attend as needed.
   5. Contractor's superintendent.
   6. Subcontractors appropriate to the progress of the work.
   7. Suppliers and manufacturer's representatives as appropriate to the agenda.
D. Agenda:
   1. Review and approval of minutes from previous meetings.
   2. Review of work progress since previous meeting.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period before the next meeting.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to work.
E. Contractor to record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.08 PROGRESS PHOTOGRAPHS

A. Submit digital photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
C. Photography Type: Digital; electronic files.
D. In addition to periodic, recurring views, take photographs of each of the following events:
    1. Completion of site clearing.
    2. Excavations in progress.
    3. Foundations in progress and upon completion.
    4. Structural framing in progress and upon completion.
    5. Enclosure of building, upon completion.
E. Take photographs as evidence of existing project conditions as follows:
    1. Interior views.
    2. Exterior views.
F. Views:
    1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.
    2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
    3. Consult with Architect for instructions on views required.
    4. Provide factual presentation.
    5. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
    1. Delivery Medium: Via email.
    2. File Naming: Include project identification, date and time of view, and view identification.
    3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.09 COORDINATION DRAWINGS

A. Refer to "Common Work Results" in Mechanical and Electrical Specifications for requirements.
B. Prior to construction occurring above grade plane, submit Mechanical/Electrical Coordination Drawings for design team review.

3.10 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
    1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
    2. A resolution to an issue which has arisen due to field conditions and affects design intent.
B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
    1. Prepare a separate RFI for each specific item.
        a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
        b. Do Not forward requests which solely require internal coordination between subcontractors.
D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
    1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
    2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
        a. Approval of substitutions.
        b. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

c. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question.
   a. They will be rejected.
   b. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Discrete and consecutive RFI number, and descriptive subject/title.
3. Issue date and requested reply date no sooner than 7 working days.
4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

3.11 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
   a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.12 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

1. Prepare clearly identified shop drawings or schedules to this specific project, containing only data applicable. Include with the shop drawings or schedules a letter of transmittal listing and dating the submitted drawings in sets.
2. Contractor to review all submittals prior to submittal to Architect, and indicate such review with a stamp and signature. Review submittals for conformance to Drawings, Specifications, coordination with other trades and adjacent construction and verification of field dimensions. Failure of Contractor to adequately review submittals shall be cause for rejection.
3. Prepare and submit electronically (with exception for color charts and samples) to Architect for review, all shop drawings and manufacturers catalog sheets showing illustrated cuts of items to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, weights and arrangements. Each submittal to include a transmittal on contractor letterhead. Submittal to be in the form of one combined PDF, labeled with project name, professionally assembled so all documents are facing the same way.

C. If equipment other than that used in the design of this project is proposed to be used, the Contractor and/or supplier shall verify electrical differences, dimension variations and weight increases. The Contractor shall be responsible for any extra costs incurred as a result of equipment substitutions.

D. Samples will be reviewed for aesthetic, color, or finish selection.
1. Unless otherwise specified, submit samples of size, and nature representing typical qualities. Where required, submit a sufficient number of samples to demonstrate the complete range of variations of the material or quality. Written acceptance of the Architect is required prior to ordering any item for which samples are required.

E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.13 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.14 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit Demonstration and Training recorded training modules.

E. Submit for Owner's benefit during and after project completion.

3.15 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.16 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
      a. When labeling shop drawings or product data, include the Specification Section number of where the product is specified for a submittal . For example, for cavity wall insulation Section 07 21 00 - Insulation does not require an insulation submittal, but Section 04 20 00 - Non-Bearing Unit Masonry does require that submittal.
   4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will be rejected.
   5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Deliver submittals to Architect via email.
      b. Submit samples to Architect's office, securely packaged, with the name of the Owner and Project clearly indicated on the package exterior. Each physical sample shall have a label or tag, firmly attached to the sample, bearing the following information: (a) Name of Owner and Project, (b) Name of Supplier, (c) Name of Contractor, and (d) Product information such as manufacturer's designation, finish, type, class, grade, etc. as is appropriate. The Architect will retain one copy of each sample.
      c. Deliver samples to Construction Manager at business address and submittals via email.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. When submitting multiple submittals at the same time, provide the Architect with a priority list for review.
      b. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      c. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
      d. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
   7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   8. When revised for resubmission, identify all changes made since previous submission.
   9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
   10. Submittals not requested will not be recognized or processed.
B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Submit concurrently with related shop drawing submittal.
   4. Do not submit (Material) Safety Data Sheets for materials or products.
   5. Submit sustainable design reporting submittals under separate cover.
C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
      a. Contractor is to generate shop drawings based on the information identified in the contract documents and notify the architect of discrepancies in the documents.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
D. Samples Procedures:

1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.17 SUBMITTAL REVIEW

A. The Architect will take one of the following actions on submittals:
   1. “Reviewed”: Contractor shall proceed with ordering and/or fabrication.
   2. “Review Comments”: Contractor shall proceed with ordering and/or fabrication after taking into account noted comments.
   3. “Rejected”: Contractor shall provide a submittal that meets the intent of the specifications.
   4. “Revise and Resubmit”: Contractor shall modify submittal to address comments and resubmit.

B. Submittals for Information: Architect will not acknowledge receipt, and take no other action.

END OF SECTION 01 30 00

SECTION 01 31 26
ELECTRONIC BACKGROUND DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. The Architect will provide the Contractor with one (1) electronic copy of the background drawing relevant to their request. Requested files will be provided via email to the Contractor in AutoDesk AutoCAD format.

B. The terms and conditions on the attached form "Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" apply to all Electronic Documents issued by Wold Architects and Engineers or it's consultants for the project.

C. Electronic Document Availability

1. Pre Bid: AutoCAD backgrounds pertaining only to Survey and/or proposed grading will be available prior to bid. Requesting Contractors must complete "Attachment A - Agreement Between Civil Engineer and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" at time of request.
2. After Bid: Backgrounds as requested by the awarded contractors at the discretion of the Architect or Engineer. Electronic Documents are available upon completion of "Attachment A - Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" by the:
    a. General Contractor on the project.
    b. Construction Manager on the project.

D. See attached form "Attachment A – Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media."

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01 31 26

SECTION 01 31 27

ELECTRONIC BACKGROUND DOCUMENTS-ATTACHMENT A

AGREEMENT BETWEEN ARCHITECT AND CONTRACTOR FOR THE TRANSFER OF COMPUTER AIDED DRAFTING (CAD) FILES ON ELECTRONIC MEDIA

Village of Long Grove - Village Hall Addition and Remodel

The purpose of this agreement is to grant permission from the Transmitting Party (Architect and/or Engineer) to the Receiving Party (Contractor, Bidder, and/or Construction Manager) for the Receiving Party's use of Electronic Media on the Project, and to set forth the terms of such use. Electronic Media is defined to include all data or files transmitted. All Electronic Media is considered confidential and containing business proprietary information. Wold Architects & Engineers and its consultants grant the Receiving Party a limited license to use Electronic Media issued by Wold Architects & Engineers exclusively for this Project. The terms are set forth as follows:

The Electronic Media is transmitted for the Receiving Party's convenience and remains the sole property of Wold Architects and Engineers and/or its consultants.

1 The Transmitting Party makes no warranty, expressed or implied, including warranties of merchantability or fitness for a particular purpose, respecting the Electronic Media or the files therein. The Transmitting Party makes no representation regarding the accuracy, completeness, or permanence of the Electronic Media or the files therein.

2 The Electronic Media or files therein depict information only at the specific point in time of preparation and may not include final data or represent exact as-built conditions. Addenda information or revisions made after the date indicated on the files may not have been incorporated. The Receiving Party is solely responsible for verifying all field conditions against the Electronic Media or files therein and making all necessary adjustments. The Receiving Party is solely responsible for determining whether any changes made after it receives the Electronic Documents affect any services or work it provided using the Electronic Documents and for updating any such services or work.

3 The Electronic Media and files therein are not considered to be Contract Documents as defined by the General Conditions of the Contract for Construction. In the event of a conflict between the Architect's and/or Engineer's sealed Contract Drawings and the Electronic Media files, the sealed Contract Drawings shall govern. It is the Receiving Party's responsibility to determine if any conflicts exist.

4 Neither Wold Architects and Engineers nor its consultants are responsible for any decline in accuracy or readability due to the medium on which the Electronic Media are stored, or for any unintentional transmission of computer viruses.

5 The Electronic Media and the files therein may not be used by the Receiving Party for any purpose other than as a convenience in the preparation of Shop Drawings, layout, and other purposes related to the Project. Any use or reuse of the Electronic Media of the files therein, by the Receiving Party or others, are at the Receiving Party's sole risk and without liability or legal exposure to the Architect, Engineers, or their consultants.

6 The Architect reserves the right to determine what content will be distributed to the Receiving Party.

BY SIGNING BELOW, THE RECEIVING PARTY AGREES TO THE TERMS SET FOR BY THIS AGREEMENT.

AUTHORIZED ACCEPTANCE:

By Receiving Party/Contractor of Record

_____

Signature

_____

Print Name and Title

_____

Print Name of Company

_____

Date

END OF SECTION 01 31 27

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.
B. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
D. Within 10 days after joint review, submit complete schedule.
E. Submit updated schedule with each Application for Payment.
F. Submit in PDF format.

1.03 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
B. Identify each item by specification section number.
C. Identify work of separate stages and other logically grouped activities.
D. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
E. Provide legend for symbols and abbreviations used.

3.03 CONSTRUCTION PROGRESS BAR CHART SCHEDULE

A. Prepare a horizontal bar chart schedule for complete construction duration.

3.04 CONTRACTORS LOOK AHEAD SCHEDULE

A. Prepare a horizontal bar chart look ahead schedule to project work to be completed before the next construction meeting.
B. Present the schedule at each construction meeting.

3.05 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.
B. Identify the first work day of each week.

3.06 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.
B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
C. Annotate diagrams to graphically depict current status of Work.
D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
E. Indicate changes required to maintain Date of Substantial Completion.
F. Submit reports required to support recommended changes.

3.07 DISTRIBUTION OF SCHEDULE

A. Include a revised bar chart schedule with each Application and Certificate for Payment.
B. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
C. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 32 16

SECTION 01 45 35
SPECIAL INSPECTIONS

TURN OFF SPECIFIER NOTES

PART 1 GENERAL

1.01 INTENT AND CONDITIONS

A. ***SPECIFIER NOTE: This specification is intended for use when there is not Structural work or a Structural Engineer on the project, but code required inspections are required for items like firestopping, EIFS, etc. (see the schedule Section 01 45 35.10)***

B. Intent
   1. Define and coordinate special inspection services.
   2. Provide a greater level of confidence that the specified work is constructed in compliance with the contract documents and the intent of applicable codes including Chapter 17 of the adopted International Building Code (IBC) as adopted by the current State Building Code.
   3. Special inspection services are intended to assist in determining probable compliance of the work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the contract documents.

C. Conditions
   1. If inspection of a fabricator's work is required, the Owner's representative may require testing and inspection of the work at the plant, before shipment. Owner and Architect reserve the right to reject material not complying with the Contract Documents.
   2. Refer to individual technical specification sections for specific qualifications, inspections, tests, frequency and standards required. Testing and inspection shall be performed in accordance with the referenced standard for the specific material or procedure unless other criteria are specified. In the absence of a referenced standard, tests shall be performed in accordance with generally accepted industry standards.
   3. Work shall be checked as it progresses. Failure to detect any defective work or materials shall not prevent later rejection if defective work or materials are discovered, nor shall it obligate Owner to accept such work.
   4. Special inspection, and periodic inspections by the Building Official do not preclude the normal field involvement and site observations by Architect.
   5. Special inspection, and periodic inspections by the Building Official do not relieve the Contractor of any responsibility to complete the work in accordance with the approved drawings and specifications.
   6. Testing agents and/or special inspectors may not waive or alter contract requirements, or approve or accept any portion of the work unless specifically authorized by the Architect. They may not assume any duties of the Contractor, and they have no authority to stop or reject work.

1.02 QUALIFICATIONS

A. Testing Agency: An approved independent testing agency acceptable to the Owner and Architect and meeting the following:
   1. Authorized to operate in the State the project is located and experienced with the requirements and testing methods specified in the Contract Documents.
   2. Have available testing equipment that is calibrated, at reasonable intervals, by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.
   3. Provide individuals performing tests and taking samples with appropriate certifications for work performed.

B. Special Inspector: An appropriately certified inspector. Unique special inspector requirements, for specific materials and systems, are noted in related technical specification sections.

1.03 RESPONSIBILITIES

A. Special Inspectors:
   1. Inspect the work assigned for conformance with the building department approved plans, specifications, and applicable material and workmanship provisions of the code. Perform inspection in a timely manner to avoid delay of work.

2. Bring nonconforming items to the immediate attention of the contractor for correction. If uncorrected after a reasonable period of time, bring to the attention of the Building Official, Construction Manager/General Contractor and to the Architect.
3. Submit inspection reports to the Building Official, Construction Manager/General Contractor, the Contractor performing the work, the Architect, and other designated persons in accordance with the special inspection schedule.
4. Submit a final signed report stating whether the work requiring special inspection was, to the best of his/her knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the code.
5. Sign the Statement of Special Inspections in conjunction with other responsible parties.
6. Attend preconstruction meeting to review scope of special inspection.

B. Testing Agency:
1. Test the work assigned for conformance with the building department approved plans, specifications, and applicable material provisions of the documents. Perform tests in a timely manner to avoid delay of work.
2. Submit test reports to the Building Official, Construction Manager/General Contractor, the Contractor performing the work, the Architect, and other designated persons in accordance with the special inspection schedule.
3. Sign the special inspection schedule in conjunction with other responsible parties.
4. Attend a preconstruction meeting to review scope of structural testing.

C. Construction Manager/General Contractor, and the Contractor performing the work:
1. Attend a preconstruction meeting to review scope of structural special inspection.
2. Provide special inspector with approved plans, specifications and approved shop drawings.
3. Post or make available the structural special inspection schedule within its office at the job site. Also, provide adequate notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
4. Provide special inspectors access to the approved plans and specifications at the job site.
5. Review all reports issued by special inspectors.
6. Retain, at the job site, all reports submitted by the special inspectors for review on the Building Official's request.
7. Correct deficiencies identified in inspection or testing reports in a timely manner.
8. Provide safe access to the work requiring inspection or testing.
9. Provide labor and facilities to provide access to the work, to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.
10. Verify conformance of the work with specified construction tolerances.
11. Inspections by Building Official: Provide adequate notice for inspections performed by the building official, as required by the adopted International Building Code, the State Building Code, and local ordinances.
12. Sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.

D. Owner:
1. Establish direct funding to provide for cost of special inspection services.
2. Provide special inspectors and testing agencies with full access to the site at all times.
3. Sign the Statement of Special Inspection in conjunction with other responsible parties.

1.04 PAYMENT

A. Owner will employ and pay for services of the special inspectors and testing agency to perform required inspection.

B. Unless noted otherwise, the Contractor shall provide and pay for all materials, samples, mock-ups, and assemblies required for testing and inspection and shall pay for shipping costs related to delivery of such items. Testing agency will pay for shipping costs of samples transported from site to lab.

C. If items requiring testing or inspection are enclosed, embedded or obscured prior to testing or inspection or if such items are placed without tests or inspections, the Contractor shall pay for the costs of any exploratory work deemed necessary by the Construction Manager/General contractor/Architect to verify compliance

with the Contract Documents.

D. Contractor shall pay for the costs of any retests or re-inspections caused by work that does not comply with the Contract Documents based on initial tests or inspections, or work that is later revised or replaced by the Contractor. This does not include revisions requested by the Owner.

1.05 INSPECTION NOTICE

A. Provide minimum of 24 hours notice for all items requiring testing or inspection. Items requiring testing and inspection services prior to or during placement shall not be placed until testing and inspection services are available. Items requiring testing and inspection services after placement shall not be enclosed or obscured until testing and inspection services are performed.

1.06 REPORTS

A. Testing agency and special inspectors shall submit reports for structural testing and special inspection in a timely manner to the Construction Manager/General Contractor, Contractor performing the work, Building Official, and Architect. Provide reports of daily activities to the Construction Manager/General Contractor. Submit reports to the Construction Manager/General Contractor on a daily basis. Provide summary reports to the Building Official and Architect on a monthly basis unless they request otherwise.

B. Provide reports for ongoing work, containing the following information:

1. Date issued.
2. Project title and number.
3. Firm name and address.
4. Name and signature of tester or inspector.
5. Date and time of sampling, test, or inspection.
6. Identification of product and specification section.
7. Location in project, including elevations, grid location and detail.
8. Type of test or inspection.
9. Whether test specimens, test results or observations indicate compliance with Contract Documents. Specifically state any discrepancies
10. Types and locations of discrepancies found in work
11. Work required performed to correct discrepancies and work performed to correct previously noted discrepancies. Discrepancies corrected during an inspection need not be reported
12. Submit certified final special inspection report stating that, to the best of the special inspector's knowledge, the work requiring special inspection conformed to the Construction Documents.

1.07 FREQUENCY OF TESTING AND INSPECTION

A. For detailed requirements, see individual technical specification sections and the structural testing and special inspection schedule.

1.08 PROTECTION AND REPAIR

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

1.09 TESTS TO DEMONSTRATE QUALIFICATION

A. Any tests required to qualify the Contractor or the workers for any phase of the work, shall be performed at no additional cost to the Owner.

B. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the Architect may require applicable tests to establish a basis for acceptance or rejection. The Contractor shall pay for these tests.

C. The Architect reserves the right to require certification or other proof that the system proposed is in compliance with specified tests, criteria or standards. A representative of an independent testing agency shall sign the certificate.

1.10 STATEMENT OF SPECIAL INSPECTIONS

A. The parties involved shall complete and sign the Statement of Special Inspection. Statement to be complete at time of permit issuance.

B. The completed Statement is an element of the construction documents and after permit issuance, becomes part of the building department approved plans and specifications.

END OF SECTION 01 45 35

STRUCTURAL TESTING AND SPECIAL INSPECTION SCHEDULE

Project Name Village Of Long Grove - Village Hall Addition And Remodel ____Project No. [233052]
Location 3110 Old McHenry Road, Long Grove, Illinois 60047
[p Address] p City] p State] p Zip]
Permit No.

STRUCTURAL TESTING AND SPECIAL INSPECTION

Specification Section/Article	Description (2)	Type of Inspector (3)	Report Frequency	Assigned Firm (4)
031000	Concrete Formwork	SI-S	Each Visit	
072413	Post Intalled Anchors	SI-T or SI-S	Each Visit	
032000	Concrete Reinforcement	SI-S	Each Visit	
033000	Cast-in-Place Concrete Tests	TA	Each Visit	
033000	Cast-in-Place Concrete Inspections	SI-S	Each Visit	
078100/078120	Fireproofing	SI-T	Each Visit	
078400	Firestopping	SI-T	Each Visit	

Note: This schedule is to be filled out when applying for a building permit.
(1) Permit No. to be provided by the Building Official.
(2) Use descriptions per IBC Section 1704, as adopted by the State Building Code.
(3) Special Inspector - Technical, Testing Agency.
(4) Firm contracted to perform services.

Each appropriate representative shall sign below:

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

Legend: SI-T = Special Inspector - Technical F = Fabricator
TA = Testing Agency

Accepted for the Building Department by: Date:

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering
B. Temporary utilities.
C. Temporary telecommunications services.
D. Temporary sanitary facilities.
E. Temporary Controls: Barriers, enclosures, fencing, and construction dust control.
F. Security requirements.
G. Vehicular access and parking.
H. Waste removal facilities and services.
I. Project identification sign.
J. Field offices.

1.02 DEWATERING

A. Provide temporary means and methods for dewatering all temporary facilities and controls.
B. Maintain temporary facilities in operable condition.

1.03 TEMPORARY UTILITIES

A. Owner will provide the following:
    1. Electrical power, consisting of paying for utility charges on existing services.
        a. Temporary power and lighting, refer to Div. 26.
    2. Water supply, consisting of paying for utility charges on existing services.
B. Contractor will:
    1. Engage appropriate local utility company to install temporary service or connection to existing service. Where the utility company provides only part of the service, provide the remainder of the service with matching, compatible materials and equipment, comply with utility company requirements.
        a. Arrange with the Utility Company, Owner and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
        b. Provide adequate capacity at each stage of construction. Provide mobile power as needed before temporary power is connected.
        c. If required, obtain easements to bring temporary utilities to the project site, where Owner's easements cannot be used for that purpose.
C. Existing toilet facilities may not be used.
    1. Provide and maintain required sanitary facilities and enclosures. Provide at time of project mobilization.
    2. Maintain daily in clean and sanitary condition.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Provide a portable cellular telephone for superintendent's use.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way, exiting through the construction site and for public access to existing building.
    1. Review exiting that will be blocked with the local Fire Marshal and gain approval for exiting of those areas prior to blocking the exits.
C. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
D. Provide temporary fencing at the drip line for protection for plants and trees designated to remain. Replace damaged items.
E. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot (1.8 m) high fence around construction site when designated on the site plan; equip with vehicular and pedestrian gates with locks.

1.07 INTERIOR PROTECTION

A. Provide temporary sound insulated partitions as indicated to separate work areas from the Owner's occupied areas, to prevent penetration of dust and moisture into the Owner's-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing, fiberglass insulation and gypsum board over plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces.
   1. Maximum flame spread rating of 75 in accordance with ASTM E84.

C. Floor Protection:
   1. Manufacturer/Product: RamBoard, Inc.: RamBoard; www.ramboard.com.

D. Furniture and Equipment Protection:
   1. Cover all furniture and equipment remaining in the space with polyethylene. Seal with tape to prevent dust/dirt from reaching the furniture and equipment.

1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and the Owner's operations from unauthorized entry, vandalism, or theft.

B. Provide security and facilities to protect Work, and the Owner's operations from unauthorized entry, vandalism, or theft.

1.09 PEST CONTROL

A. Once building enclosure is nearing completion, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests.
   1. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion.
   2. Perform control operations lawfully, using environmentally safe materials.

1.10 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and the Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Existing parking areas designated by the Owner may be used for construction parking.

H. Do not allow vehicle parking on existing pavement.

I. Remove snow and ice as required to minimize accumulations and provide access to and throughout the site as required to complete the work/fire department access.

1.11 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids.
   1. Debris shall be removed from the construction site and police exterior project site area on a weekly basis at a minimum to clean-up any wind-blown or excess construction materials or debris and dispose of in construction dumpsters to maintain a clean project site.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 HOUSEKEEPING

A. Do not allow debris to accumulate on-site or within the building work areas. The Contractor shall implement and provide the following cleaning services:
   1. Building Interior:

a. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
b. Owner occupied areas, with construction activity or adjacent to dustproof enclosures floors and walls that are contaminated by discharge or release from work area or by dust migration or transport shall be HEPA vacuumed on a daily basis.
c. Once floor slabs are in place, walk-off mats shall be provided at all exterior entrances and at entrances to dustproof enclosure areas that are utilized by the workers.
1) To prevent transport of dirt and debris to other surfaces or discharge into the air, mats shall be cleaned/HEPA vacuumed on a daily basis (more frequently if visible dirt and debris are observed) and change out mats on a monthly basis.
d. Areas that workers have access to with final floor finish in place shall be HEPA vacuumed on a daily basis. Carpeted major circulation paths shall be covered with poly film guard. Replace poly film guard when it develops holes or tears as they occur. Poly film guard to be replaced if left in place over 45 days. Horizontal and vertical surfaces shall be wiped down as construction dust has accumulated.
e. Where Contractor has periodic access to ancillary spaces occupied by Owner, thoroughly clean after each use, including HEPA vacuuming, so as to not disrupt Owner's ongoing operations.

2. Exterior/Site:
a. On a daily basis:
1) Broom clean the sidewalks to remove dust, loading dock/steps, at project construction personnel access locations, and material delivery or waste disposal locations.
2) Remove debris from and police the exterior project site area to clean up any and remove windblown construction materials or debris or materials that could become windblown and dispose of in Contractor's construction dumpsters.
3) Pickup and remove debris on the site from the work, including windborne debris that has blown onto site areas or adjacent property.
4) Repair any damage to the temporary construction fence system.
5) Repair damage to the site stormwater temporary erosion control system and storm water management systems.
b. Weekly remove dust and debris from ledges.
c. When visible dust and debris accumulate on site pavement, perform sweeping operations and related work to capture and remove those materials.

B. Failure to comply with housekeeping procedures.
1. A written warning will be issued for correction by the Architect.
a. If correction notice is not complied within 8 hours, Owner may take over cleaning.
b. Cost will be back charged to the Contractor(s) by Change Order.

1.13 CONSTRUCTION DUST CONTROL

A. Provide Construction Dust Control on projects with areas occupied during construction, including dust producing construction during punchlist correction.
B. Air Quality Contaminant Control:
1. Ventilate barricaded construction areas by use of fans to the outside of building.
2. Maintain a minimum negative pressure of -0.01 inch (-0.254 mm) WC with door closed at barricade entrance openings by use of fans vented to outside of building.
a. Rebalance air handling equipment to maintain correct airflow to occupied areas as required.
3. Secure operable exterior windows and interior doors/windows not required for construction access as required to maintain negative pressure.
4. Provide additional local exhaust during welding.
C. Dustproof enclosures:
1. Install dustproof enclosures for work when required to protect areas occupied by the Owner from dust, debris and damage.
a. Enclosures must be tight to cut off any flow of dust particles into occupied areas by sealing openings with tape or other impenetrable sealant to seal barrier wall seams, cracks around window and door frames, exhaust system ductwork, pipes, floor penetrations, joints and ducts.

2. Block supply and return ventilation as to not recirculate air from construction area to air handlers supplying occupied areas or to prevent contamination of existing ductwork to remain.
3. Install filters on exterior air handling equipment intakes adjacent to exhaust fans.
4. For work creating dust outside of dustproof enclosures, provide temporary sealed enclosures around the work area.

D. Procedures:
1. Contractor shall maintain all construction dust control devices throughout the construction period.
a. Traffic between barricaded areas and open areas shall be kept to a minimum.
1) Instruct workers to refrain from tracking dust into adjacent occupied areas or opening windows or doors allowing construction dust/airborne contaminants into adjacent occupied areas.
b. Whenever possible, transport materials and refuse into an area from an external site without violating occupied areas.
c. Execute work by methods to minimize raising dust from construction operations.
1) Spray surfaces with water mist during dust-producing interior demolition activities.

1.14 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.
B. Erect on site at location indicated.
C. No other signs are allowed without the Owners permission except those required by law.

1.15 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
B. Provide space for Project meetings, with table and chairs to accommodate 16 persons.
C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.16 OPERATION, REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
1. Protect water piping from damage caused by freezing temperatures and similar elements.
2. Maintain markers and protect underground utilities from damage during excavation operations.
B. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Date of Substantial Completion.
C. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
D. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
E. Clean and repair damage caused by installation or use of temporary work.
F. Restore existing facilities and exterior landscaping used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 50 00

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
C. Pre-installation meetings.
D. Cutting and patching.
E. Surveying for laying out the work.
F. Cleaning and protection.
G. Starting of systems and equipment.
H. Substantial Completion and Final Completion procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.03 COORDINATION

A. See Section 01 10 00 for occupancy-related requirements.
B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
C. Notify affected utility companies and comply with their requirements.
D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
G. Coordinate completion and clean-up of work of separate sections.
H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

2.02 CLEANING MATERIALS

A. Cleaning materials as recommended by manufacturer of surface to be cleaned, as well as recommended by the cleaning material manufacturer for those materials being cleaned.
B. Vacuums that are HEPA rated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Architect thirty days in advance of meeting date.
D. Prepare agenda and preside at meeting:
    1. Review conditions of examination, preparation and installation procedures.
    2. Review coordination with related work.
E. Contractor to record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.04 FINAL CLEANING COORDINATION MEETING

A. When requested by the Owner, the Construction Manager or General Contractor shall coordinate a final cleaning coordination meeting 30 days prior to the start of cleaning to establish the phasing of the areas to be final cleaned by the Cleaning Contractor and for reviewing the requirements of the final cleaning as required for Owner move-in.
B. Attendants:
    1. Owner.
    2. Architect.
    3. Construction Manager or General Contractor.
    4. Cleaning Contractor.
C. Cleaning Contractor in conjunction with the Construction Manager or General Contractor shall provide a detailed schedule, including a work plan, respective dates for each area and tasks for the work and quantity of personnel.

3.05 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect of any discrepancies discovered.
C. Contractor shall locate and protect survey control and reference points.
D. Control datum for survey is that indicated on drawings.
E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
H. Utilize recognized engineering survey practices.
I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
    1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
    2. Grid or axis for structures.
    3. Building foundation, column locations, ground floor elevations.
J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.06 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.07 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
    1. Verify that construction and utility arrangements are as indicated.
    2. Report discrepancies to Architect before disturbing existing installation.
    3. Beginning of alterations work constitutes acceptance of existing conditions.
B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
    1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 .
C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
    1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
    2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
D. Remove existing work as indicated and as required to accomplish new work.
    1. Remove items indicated on drawings.
    2. Relocate items indicated on drawings.
    3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
    4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
    1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
    2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
    3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
        a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
        b. Provide temporary connections as required to maintain existing systems in service.
    4. Verify that abandoned services serve only abandoned facilities.
    5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
F. Protect existing work to remain.
    1. Prevent movement of structure; provide shoring and bracing if necessary.
    2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
    3. Repair adjacent construction and finishes damaged during removal work.
G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
    1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation

to Architect.

2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.08 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.
1. In existing work, minimize damage and restore to original or specified condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.09 PROTECTION OF INSTALLED WORK

A. See Section 01 50 00 - Temporary Facilities and Controls for temporary protective covering materials for flooring.

B. Protect installed work from damage by construction operations.

C. Provide special protection where specified in individual specification sections.

D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace moisture soaked materials.
H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
I. Prohibit traffic from landscaped areas when possible. Repair when damaged.
J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.
B. Coordinate start-up schedule with Architect and Owner prior to start-up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, grease, dust, fingerprints polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Replace filters of operating equipment as specified in Division 23 specifications
G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
H. Clean site; sweep paved areas, rake clean landscaped surfaces.
I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
J. Coordinate with the Construction Manager or General Contractor to have marred surfaces repaired, patched or touched-up to match adjacent surfaces.
K. Maintain cleaning until the building or portion thereof, is occupied by the Owner.

3.14 SUBSTANTIAL AND FINAL COMPLETION PROCEDURES

A. Make submittals that are required by governing or other authorities.
    1. Provide copies to Architect and Owner.
B. Obtain and submit to the Architect a Certificate of Occupancy from AHJ.
C. Provide preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
D. Notify Architect in writing when work is considered ready for Architect's Substantial Completion inspection.
E. Architect will visit the project to evaluate the request for issuance of a Certificate of Substantial Completion.

1. If the Architect concurs that the Project is substantially complete, the Architect will deliver a Certificate of Substantial Completion and a list of work items necessary for completion or correction prior to request for inspection for final completion.
2. If the Architect determines that the work is not substantially complete, the Architect will deliver to the Contractor a written statement including reasons.

F. Complete work on the items required by the Architect for achieving substantial completion and make additional written requests for issuance of a Certificate of Substantial Completion until the Architect determines that sufficient Work has been performed.

G. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

H. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

I. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

J. When the punchlist work is considered complete, submit written certification that:
1. When work is considered finally complete and ready for Architect's Final Completion inspection.
2. The Building Permit has been finalized by the AHJ and submit a copy for the Architects and Owners record.

K. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
1. Should Architect consider that the Work is incomplete or defective:
   a. Architect will notify the Contractor in writing, listing the incomplete or defective work.
      1) Take immediate steps to remedy the stated deficiencies and send a second written certification to Architect that the Work is complete.
      2) Architect will reinspect the Work.
2. Should Architect perform reinspection's due to failure of the Work to comply with the claims of status of completion made by the Contractor:
3. Owner will compensate Architect for such additional services.
   a. Owner will deduct the amount of such compensation from the final payment.

END OF SECTION 01 70 00

SECTION 01 74 19
SUSTAINABLE WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:

1. Aluminum and plastic beverage containers.
2. Corrugated cardboard.
3. Wood pallets.
4. Clean dimensional wood.
5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 10 00 - Site Clearing for use options.
6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
9. Precast concrete panels: May be used for erosion control or landscape features.
10. Asphalt paving: May be recycled into paving for project.
11. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
12. Glass.
13. Gypsum drywall and plaster.
14. Plastic buckets.
15. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
16. Asphalt roofing shingles.
17. Paint.
18. Plastic sheeting.
19. Rigid foam insulation.
20. Vinyl siding.
21. Windows, doors, and door hardware.
22. Plumbing fixtures.
23. Mechanical and electrical equipment.
24. Fluorescent lamps (light bulbs).
25. Acoustical ceiling tile and panels.

F. Contractor shall submit monthly Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

1. Include the following information:
   a. Material category.
   b. General point of waste.
   c. Total quantity of waste in tons (tonnes).
   d. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
   e. Quantity of waste recycled, both estimated and actual in tons (tonnes).
   f. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).

g. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

H. Methods of trash/waste disposal that are not acceptable are:
1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

J. Minnesota B3 Submittal: Contractor shall provide necessary documentation as required by Minnesota B3 Guidelines.

K. LEED Submittal: Contractor shall provide necessary documentation as required by LEED.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
1. Submit to Architect for Owner's review and approval.
2. If Owner wishes to implement any cost alternatives, the Contract Price will be adjusted as specified elsewhere.
3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
4. Describe as many alternatives to landfilling as possible:
a. List each material proposed to be salvaged, reused, or recycled.
b. List the proposed local market for each material.
c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.

C. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

D. Waste Management Plan: Include the following information:
1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
a. List each material proposed to be salvaged, reused, or recycled.
4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

E. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.

2. Submit Report on a form acceptable to Owner.
3. Landfill Disposal: Include the following information:
    a. Identification of material.
    b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
    c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
    a. Identification of material.
    b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
    c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following information for each:
    a. Identification of material, including those retrieved by installer for use on other projects.
    b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
    c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
    e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
    a. Identification of material and how it was used in the project.
    b. Amount, in tons or cubic yards (cubic meters).
    c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 30 00 - Administrative Requirements for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 50 00 - Temporary Facilities and Controls for additional requirements related to trash/waste collection and removal facilities and services.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
    1. Prebid meeting.
    2. Preconstruction meeting.
    3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
    1. Provide containers as required.
    2. Provide temporary enclosures around piles of separated materials to be recycled or salvaged when required by local authorities.
    3. Provide adequate space for pick-up and delivery and convenience to subcontractors.

4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01 74 19

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.
B. Operation and maintenance data.
C. Warranties and bonds.

1.02 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days after Substantial Completion. This copy will be reviewed and returned, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form and one digital copy 60 days before final inspection.
C. Warranties, Bonds and other required forms:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
D. Final Adjustment of Accounts.
   1. Make submittals within 30 days prior to final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Change Orders and other modifications (accepted PR's, SI's and CCD's) to the Contract.
   4. Reviewed shop drawings, product data, and samples.
   5. Field test reports.
B. Ensure entries are complete and accurate, enabling future reference by Owner.
C. Store record documents separate from documents used for construction in a location protected from the weather.
D. Record information concurrent with construction progress.
E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions accepted during construction.
F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Label each set of Drawings "RECORD DOCUMENTS".
   2. Measured depths of foundations in relation to finish first floor datum.
   3. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   5. Field changes of dimension and detail.
   6. Details not on original Contract drawings.

G. Shop Drawings – Label each set by corresponding specification section. At the completion of the project, provide the Owner with one complete set, reviewed and stamped by architect, organized by specification section in the following formats:
   1. Paper (various sizes) folded to 8 1/2” x 11” and boxed with project name and completion date clearly labeled on exterior.
   2. Scanned PDF copy on a flash drive, ordered by specification section.

3.02 OPERATION AND MAINTENANCE DATA

A. Physical Format for Binders:
   1. Commercial quality three-ring binders with durable , cleanable plastic cover in 8-1/2 x 11 inch (215.9 x 279.4 mm) size and maximum thickness of 2 inches (50.8 mm).
      a. When multiple binders are used, correlate the data into related consistent groupings.
   2. Manufacturer's printed data or typed pages on 20 pound (9.072 kg) weight white paper.
   3. Provide fly-leaf for each separate product, or each piece of operating equipment.
      a. Provide typed description of product, and major component parts of equipment.
      b. Provide indexed tabs.
   4. Identify each volume with typed or printed title "OPERATING, MAINTENANCE AND WARRANTY INSTRUCTIONS". Listing:
      a. Title of Project
      b. Identity of separate structure as applicable.
      c. Identity of general subject matter covered in the manual.
   5. Drawings:
      a. Provide reinforced punched binder tab, bind in with text.
      b. Fold larger drawings to the size of the text pages.

B. Digital Format:
   1. Submit one PDF copy on a flash drive.

C. Content:
   1. Arrange neatly typewritten table of contents for each volume, in the following systematic order.
      a. Contractor, name of responsible principal, address and telephone number.
      b. A list of each product required to be included, indexed to the content of volume.
      c. List, with each product, the name, address and telephone number of:
         1) Contractor or installer.
         2) Maintenance contractor, as appropriate.
         3) Identify the area of responsibility of each.
         4) Local source of supply for parts and replacement.
         5) Include warranty information as specified.
      d. Identify each product by product name and other identifying symbols such as set in Contract Documents.
   2. Product Data
      a. Include only those sheets which are pertinent to the specific product.
      b. Annotate each sheet to clearly identify the specific product or part installed.
   3. Content, for moisture-protection and weather-exposed products:
      a. Manufacturer's data, giving full information on products.
         1) Applicable standards
         2) Chemical composition
         3) Details of installation
         4) Instructions for inspection, maintenance and repair.
   4. Additional requirements for maintenance data: The respective technical sections of the Project Manual.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after Substantial Completion. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized including:

1. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706, with exceptions itemized by subcontractor and amounts owed each.
2. Contractors Affidavit of Release of Liens, AIA Document G706A.
3. Consent of Surety to Final Payment on Consent of Surety Company to Final Payment, AIA Document G707.
4. Warranties and Bonds.
5. Energy Rebate Applications and specified back-up.
6. Minnesota Department of Revenue Tax Administration Form IC134, indicating compliance with Minnesota Statute 290.92: Tax Withheld at Source Upon Wages; Other Payments.

3.07 FINAL ADJUSTMENT OF ACCOUNTS TO FINAL PAYMENT

A. Submit a final statement of accounting to the Architect.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:
   a. Previous Change Orders.
   b. Allowances.

END OF SECTION 01 78 00

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee as designated by the Owner:
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc.
   2. Label each disc and container with session identification and date.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
B. Demonstration may be combined with Owner personnel training if applicable.
C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
    1. Perform demonstrations with-in one month after Substantial Completion, unless directed differently by the Owner.
    2. For equipment or systems requiring seasonal operation, perform demonstration for other season within eight months.
D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
    1. Perform demonstrations with-in one month of Substantial Completion, unless directed differently by the Owner.
E. Demonstration and Training Recording: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
    1. At beginning of each training module, record each chart containing learning objective and lesson outline.
    2. Submit media to Owner with-in two weeks of date the Demonstration and Training occured.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.
B. Owner will provide classroom and seating at no cost to Contractor.
C. Provide training in minimum two hour segments.
D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
    1. The location of the O&M manuals and procedures for use and preservation; backup copies.
    2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
    3. Typical uses of the O&M manuals.
F. Product- and System-Specific Training:
    1. Review the applicable O&M manuals.
    2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
    3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
    4. Provide hands-on training on all operational modes possible and preventive maintenance.
    5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
    6. Discuss common troubleshooting problems and solutions.
    7. Discuss any peculiarities of equipment installation or operation.
    8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
    9. Review recommended tools and spare parts inventory suggestions of manufacturers.
    10. Review spare parts and tools required to be furnished by Contractor.
    11. Review spare parts suppliers and sources and procurement procedures.
G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

3.03 DEMONSTRATION

A. Manufacturer’s onsite field technician shall demonstrate the operation of items specified in the specific Technical Sections to the Owner.
    1. A video outlining the operation of the item or system, scheduled maintenance, basic troubleshooting and care of the item or system shall be provided to the Owner by the manufacturer.

END OF SECTION 01 79 00

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. The Commissioning Agent directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.
   1. The Commissioning Agent is employed by Owner under separate contract for the scope of work in this specification.
   2. The Commissioning agent shall coordinate the scheduling of all commissioning meetings with all team members.
   3. The Commissioning Agent is not responsible for construction means, methods, job safety, or any construction management functions on the job site.

D. Each Contractor shall cooperate and allocate appropriate time to assist in the completion of all commissioning work as described herein including providing all services requiring tools or the use of tools to start-up, test, adjust or otherwise bring equipment and systems into a fully operational state.
   1. The Commissioning Agent shall coordinate and observe these procedures, but shall not perform construction or technician services.
   2. No additional costs will be allowed for required commissioning work.
   3. Systems Operation:
      a. Systems shall be fully operation prior to beginning on-site commissioning testing procedures. The Commissioning Agent shall work directly with the Building Automation System Contractor to receive the sign-off of all self performed functional tests prior to starting on-site testing procedures.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Mechanical Systems:
   1. The Commissioning process provides a systematic method to ensure all systems are installed and operating to meet the design intent of the project. The primary focus is the Building Automation System. Building Automation System verification will include point-to-point functional performance testing, sequence of operation testing, and alarm verification. In addition, the following items shall be verified:
      a. The Commissioning process provides a systematic method to ensure all systems are installed and operating to meet the design intent of the project. The primary focus is the Building Automation System. Building Automation System verification will include point-to-point functional performance testing, sequence of operation testing, and alarm verification.
         1) In addition, the following items shall be verified:
            (a) Hydronic System Flush and Fill.
            (b) Test and Balance Verification.
            (c) Equipment Start-up Verification.

(d) Systems Training Verification.

2) A successful commissioning outcome requires participation from all of the construction team and sub-contractors, the Owner's Representative, the Architect and Engineer, and Test and Balance Contractor. The Commissioning Agent will conduct regular team meetings starting in construction and continuing through project closeout.

3) Specific requirements of the construction team are delineated within this specification section as well as specific requirements may be noted in other Division 23 sections.

4) The Building Automation System contractor is required to self perform system point-to-point functional tests and provide signed-off checklists as a formal notification that the systems are installed and ready for the Commissioning Agent to begin field testing. Refer to Specification Section 23 09 00 - Building Automation System.

C. Electrical Systems:
   1. Power quality.
   2. Emergency power systems.
   3. Uninterruptible power systems.
   4. Variable frequency drives.
   5. Lighting controls other than manual switches.
   6. Electronic Safety and Security:
      a. Security system, including doors and hardware.
      b. Fire and smoke alarms.

D. Communications:
   1. Voice and data systems.
   2. Public address/paging.

E. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

F. Sound Transmission Class-rated interior partitions.

1.03 DEFINITIONS

A. Commissioning Plan: A document prepared by the Commissioning Agent to clearly communicate the commissioning approach and process to all team members. Elements of the commissioning plan include documentation of all team members and contact information, proposed milestone schedule, allocation of resources, and description of the key elements of the commissioning process.

B. Contractor: A member as designated of the construction team including but not limited to the Construction Manager/Construction Manager at Risk/General Contractor, Mechanical Contractor, Building Automation System Contractor, and/or Electrical Contractor.

C. Commissioning Agent: The designated lead person of the commissioning team.

D. Design Team: The Architect and Engineers responsible for the contract documents.

E. Deficiency Log: An issue tracking form prepared by and maintained by the Commissioning Agent. The log form shall include space for designating responsible parties, sign-offs, dates, and additional comments.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:

B. The Commissioning Agent shall submit the following documents to the Owner's Representative and Design Team as required by this specification section. The schedule for submission of these documents shall be identified within the commissioning plan:
   1. Observation Reports:
      a. To follow each site visit to document construction progress and identify issues or deficiencies.
   2. Commissioning Plan with a detailed milestone schedule to assist in coordinating the participation of all construction team members, Owner's Representative and design team:
      a. To be submitted within 60 days of the award of the commissioning contract.
   3. Flush and Fill Validation:
      a. To be submitted upon completion of the system flush and fill certifying that the procedures were witnessed and are in compliance with the specification requirements.
   4. Equipment Start-up Validation:

a. To be submitted upon completion of all equipment start-up. The intent is that all equipment is started in accordance with Specification requirements. Include factory start-up reports where required.

5. Test and Balance Validation:
6. To be submitted upon review of the certified Test and Balance report prepared by the Test and Balance Contractor.
7. Owner's Training Validation:
    a. To be submitted upon completion of all Owner training. The intent is that all training is completed in accordance with specification requirements.
8. Final Report:
    a. To be submitted upon final closeout of all deficiencies to document all activities through the commission process.

C. Additional submittal requirements for construction team members are noted in other Division 22 and 23 Specification Sections.

1.05 ROLES AND RESPONSIBILITIES

A. All parties involved in the construction process shall be involved in the commissioning process. Following is a description of the responsibilities of each party:

B. Owner/Owner's Representative:
1. Review and Comment on reports and deficiency logs.
2. Attend commissioning meetings.
3. Provide final approval for the successful completion of the commission process.

C. Design Team:
1. Attend commissioning meetings.
2. Resolve interpretations of the design intent and requirements of the contract documents.
3. Provide direction to the design team as required to closeout issues identified on the observation reports and deficiency logs.
4. Review contractor application for payment. Withhold payment as necessary to track construction progress.
5. Review and approve Operation and Maintenance manuals.

D. Commissioning Agent
1. Communicate important milestone schedule dates to the appropriate team members.
2. Coordinate and conduct commissioning team meetings.

E. Construction Team:
1. Implement commissioning tasks identified in this specification section and other Division 22 and 23 specification sections.
2. Include the costs of all commissioning activities in the contract price. No additional costs will be allowed.
3. Provide and document all test procedures required by this and other Specification Sections.
4. Complete corrective actions directed by the Design Team.

F. Test and Balance Contractor:
1. Submit test and balance work plan to include milestone schedule to the Commissioning Agent for review.
2. Provide a preliminary test and balance report prior to substantial completion to verify ventilation air quantities as necessary to obtain the occupancy permit.
3. Assist the Commissioning Agent to verify documentation of the test and balance activities.
4. Provide a final test and balance report.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 MECHANICAL COMMISSIONING DESCRIPTION

A. The purpose of the commissioning process is to provide the Owner assurance that the mechanical systems have been installed and are operating to meet the design intent. The Commissioning Agent shall provide the Owner with an unbiased, objective view of the system's installation, operation, and performance. The Commissioning Agent will coordinate all commissioning activities with the design professionals,

construction manager, contractors, subcontractors, manufacturers and equipment suppliers.

B. Commissioning work is a collaborative team effort and will include fine-tuning of control sequences and operational procedures. Commissioning will coordinate system documentation, equipment start-up, control system calibration, testing and balancing, and verification testing.

C. The commissioning team shall be made up of representatives from the owner, design professionals and construction trades. The trades represented on the commissioning team shall include, but not be limited to, sheet metal, piping and fitting, building automation, test and balance, and electrical. The lead person for each trade who will actually perform or supervise the work is to be designated as the representative to the commissioning team. Responsibility for various steps of the commissioning process shall be divided among the members of the commissioning team, as described in this section.

3.02 MECHANICAL/ELECTRICAL COMMISSIONING AGENT WORK SCOPE

A. Construction Phase:

1. Provide commissioning milestone date information to be incorporated into the overall project schedule. Coordinate with the prime mechanical contractor to develop the schedule. Coordinate with the General Contractor or Construction Manager to incorporate in to the overall schedule.
2. Provide a written commissioning plan document to clearly identify the roles and responsibilities of all commissioning team members, specific milestone dates that are incorporated into the overall project schedule, and an outline of the scope of all required field testing. The field testing scope is identified in the Building Acceptance Phase of this specification section.
3. Perform periodic construction site visits concurrent with the installation of the mechanical systems through substantial completion. Provide construction observation reports to identify equipment and system installation deficiencies related to the ability to complete systems testing for the project and for compliance with the plans and specifications.
4. Review submittals (shop drawings) for testability of ventilation equipment, temperature controls, and other water and air flow control devices.
5. Coordinate and conduct regular commissioning team meetings to clearly develop an understanding of the roles and expectations of all construction team members. Identifying deviations from the construction schedule as it relates to completing site testing and developing a plan as necessary to get the project on schedule shall be a primary focus of the meeting. Meetings shall occur weekly during construction leading up to substantial completion and continue at a minimum bi-weekly until all project issues are closed out.
6. Coordinate and direct the system-inspection activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, and frequently updated timelines and schedules and technical expertise.
7. Provide project-specific pre-functional tests and checklists. Checklists shall be distributed to the Building Automation Contractor early in the construction process to set the expectation for testing. Gather and review the current control sequences to include the approved control submittals and subsequent construction changes. Coordinate with the contractors and the design engineer to resolve any discrepancies.
8. Develop and implement equipment specific start-up test procedures to validate major equipment start-up by contractors. Verify checklists and witness start-up of equipment.
9. Witness the hydronic system flushing procedures performed by the contractor and provide a report of all activities to demonstrate compliance with the specification requirements.
10. Coordinate and lead a test and balance kick-off meeting to include the Test and Balance Contractor, Building Automation System Contractor, and the Mechanical Contractor prior to the commencement of preliminary system balancing to establish quality expectations.

B. Building Acceptance Phase:

1. Perform HVAC system functional performance testing through the front end controls interface. It is the intent of the functional performance testing to verify that the system components are wired and mapped correctly in the automation system and that the controlled components act as commanded through their full range of motion. Coordinate with the Building Automation System contractor for access to building automation system necessary to perform testing. Provide staff as necessary to

witness functional tests on devices concurrent with responses on the front-end interface. The extent of the functional performance testing is defined by specification section . Testing shall include:

C. 100% point to point verification of all HVAC component operations.
   1. Perform HVAC system sequence testing through the front end controls interface. It is the intent of the sequence testing to verify that the system components are controlled to accomplish the intent of the control sequences as written in specification section 23 09 00 - Building Automation System. Coordinate with the Building Automation System Contractor for access to building automation system necessary to perform testing. Provide staff as necessary to witness sequence tests on devices concurrent with responses on the front-end interface. The extent of sequence testing is defined by specification section 23 09 00 - Building Automation System. Testing shall include:
      a. 100% verification of system sequences of control
      b. 100% alarm verification
      c. 100% graphic representation accuracy.
   2. At the conclusion of each scheduled testing session, provide a corrective action report to the construction team. The corrective action report shall be a running log of all corrective action items to document deficiencies and to track correction progress.
   3. Perform follow-up inspections as necessary to verify that corrective action items are complete. Requests for additional fees for testing will not be accepted.
   4. Conduct regular Commissioning Team meetings through conclusion of all testing to review the deficiency log and set schedule expectations on the Contractor.
   5. All seasonally dependent system and control operations shall be tested in the appropriate season as weather permits. The testing schedule will be coordinated based on the project needs.
   6. Coordinate and oversee the work of the Test and Balance contractor. Review the Test & Balance report for accuracy and spot check report values in the field. Verification of ventilation air flows shall include verification that air flow stations are calibrated and reading within expected tolerance range.

D. Building Turnover/Occupancy Phase:
   1. Review the Operations and Maintenance manuals for both projects for accuracy and completeness. Provide comments to the Owner and project team.
   2. Review all as-built drawings for the projects for accuracy and completeness. Provide comments to the Owner and project team.
   3. Develop and submit a final Commissioning Report including a summary of the commissioning scope, a copy of all generated documentation and associated correspondence, and a copy of all field-testing results. The final commissioning report shall be delivered no later than one year after substantial completion.
   4. Document that all training of owner personnel as required by the specification has been provided.
   5. Attend the 11-month walk-thru sessions for both projects as directed by the project team, and provide comments to the Owner and project team.

E. Mechanical Systems To Be Commissioned:
   1. It is the intent that the full extent of the building automation system be tested. Refer to specification section 23 09 93 - BAS Sequence of Operations.
   2. At a minimum, the following pieces of mechanical equipment and systems shall be commissioned:
      a. Air handling systems, including air distribution and exhaust systems.
      b. Heating plant and hot water distribution systems.
      c. Chilled water plant and distribution systems.
      d. DX cooling systems
      e. Computer room cooling systems
      f. Electric heating systems
      g. Domestic hot water systems

F. Electrical Systems To Be Commissioned:
   1. At a minimum, the following pieces of electrical equipment and systems shall be commissioned:
      a. Emergency generator.
      b. Variable frequency drives.
      c. Lighting control systems.

3.03 COMMISSIONING - CONSTRUCTION TEAM WORK SCOPE

A. Commissioning Team:
   1. The General Contractor/Construction Manager/Construction Manager at Risk and each contractor shall designate a single individual as the primary contact for all commissioning activities.

B. Construction Schedule:
   1. The overall construction schedule and scheduling the work of all trades is the responsibility of the construction team. The commissioning process does not relieve any contractors from their obligation to complete all portions of work in a satisfactory manner.

C. Commissioning Team Meetings:
   1. Commissioning team meetings will be scheduled regularly starting in construction and continuing through project closeout. Meetings should be anticipated to be weekly. Costs to cover meeting activities shall be included in the Contractor's bid. Attendance at meetings is mandatory for all contractors with open issues.

D. Submittal Review:
   1. The Commissioning Agent will be copied on all submittals reviewed by the Design Team. Submittals shall include the manufacturer's recommended start-up procedures or testing checklist. In addition, any equipment provided with factory packaged stand-alone controllers shall be provided with written control sequences and documentation of the controller point list.
   2. The Building Automation System submittal shall be copied to the Commissioning Agent for preliminary review and comment upon the initial distribution to the Design Team. The Commissioning Agent will provide comments to the Design Team to consolidate comments prior to returning to the Contractor. The final reviewed submittal will be used by the Commissioning Agent to develop checklists and testing procedures.

E. Observation Reports:
   1. The Commissioning Agent will perform periodic site inspections to review the installation for compliance with the construction documents and for specific features related to testability of ht systems. Site observation reports will be prepared and distributed to all Commissioning Team members. The Design Team will resolve any disputes related to the scope of intent of the construction drawings.

F. Construction Checklists:
   1. Will be developed and distributed by the Commissioning Agent to the Construction Team. The checklists contain criteria for accepting the equipment related to delivery, installation, and start-up.
   2. Shall be completed by the installing contractor verifying that the installation is complete in conformance to the requirements of the construction documents and the manufacturer's installation guidelines. Checklists shall be completed and reviewed prior to start-up.

G. Air and Balance Verification
   1. Provide a preliminary Test and Balance report to the Commissioning Agent for review prior to Substantial Completion of the project. The report shall include draft forms and Test and Balance procedures, the preliminary report shall include documentation of ventilation air flows as may be required for the occupancy permit.
   2. The final Test and Balance report will be reviewed for completeness and accuracy by the Commissioning Agent.
   3. The Test and Balance Contractor shall provide a field technician to work with the Commissioning Agent to verify accuracy and measurements documented in the Test and Balance report. Refer to paragraph B of this section for the scope of the verification process.

H. Functional Performance Testing
   1. On-site testing will be scheduled by the Commissioning Agent upon notification that the systems are fully operational and ready for testing. Notification by the Construction Team to the Commissioning Agent shall include the following:
      a. Construction checklists (including as required factory start-up reports).
      b. Preliminary Test and Balance Report.
      c. The Building Automation System Contractor shall return all required self performed functional test checklists as required in Part 3 of Specification Section 23 09 00 - Building Automation

System.

d. Manufacturer's written test report on electrical systems that they have been tested, approved and commissioned by the manufacturer for the following systems:
    1) Emergency generator.
    2) Variable frequency drives.
    3) Lighting control systems.

2. The Construction Team shall assist the Commissioning Agent to test the building systems in all modes of operation to ensure the components, systems and facility operate as intended for building turnover. Testing by the Commissioning Agent will include a minimum the following:
    a. Functional Performance Verification:
        1) 100% verification of all physical control points including sensor calibration and status, and output verifications. These tests shall be performed by physically measuring the condition at the sensor, observing the device state, or verifying the device action, and comparing to the value or command on the automation system graphic.
    b. Alarm Verifications:
        1) Alarm devices should be tripped, and verifying the appropriate alarm is displayed on the graphic and/or sent out as specified.
    c. Graphics Review:
        1) Verify that the automation system graphics accurately depict the actual equipment or systems, and are navigable as specified. This includes, but is not limited to: sensor or device locations on an equipment graphic matches the actual location, graphic floorplans are navigable as specified, trends and schedules are accessible, and links operate properly.
    d. Sequence Verifications:
        1) After proving the automation system points during point to point verifications, all control sequences included in the construction documents will be verified. Sequence testing will include normal operating mode and any emergency failure or standby power sequences.
    e. Integrated System Tests:
        1) Perform tests to ensure that pieces of individual equipment operate together in a system properly, and the systems operate with other systems together as a whole.
3. The Commissioning Agent will develop and witness all testing procedures. The Contractor will be required to assist in functional testing, including, but not limited to: providing access to equipment and components, the use of ladders, lifts, scaffolding and platforms, removal of access panels, opening of equipment, manipulation or operation of equipment or components, etc.
    a. After the Commissioning Agent has reviewed and accepted contractor checkout documents, Commissioning Agent witness testing will be coordinated between the Commissioning Agent and the appropriate contractors.
    b. The Contractor shall assist the Commissioning Agent with all functional testing, as required by the Commissioning Agent.
    c. The Contractor shall provide necessary setpoints on all monitor screens so that all sequences of operation can be functionally tested or assist with all sequence testing that cannot be performed with current monitor screen setpoints.
    d. The Contractor shall provide the Commissioning Agent proper system access ability to fully test the system. This includes appropriate logins and passwords.
4. Testing Failures:
    a. The Contractor may be allowed to correct & retest minor deficiencies immediately at the discretion of the Commissioning Agent. However, the Commissioning Agent reserves the right to document a failure on the deficiency list and move on to other testing if the issue will take longer than 5 minutes to correct, or if excessive failures are discovered.
    b. If 10%, or 3 instances, whichever is greater, of similar deficiencies are encountered during any portion of the commissioning process, the Commissioning Agent reserves the right to cease further testing or inspections of that particular item and identify the issue as a failure typical of all. The contractor will be responsible for re-verifying 100% of the items before the Commissioning Agent continues testing/inspecting that issue.

c. The Commissioning Agent will not provide direction to Contractors to make changes to any systems. The Contractor can choose to take responsibility for an item and make corrective actions at their discretion. If the contractor disagrees, or believes that a documented issue is beyond their contracted scope of work, they may respond in writing to the Design Team for review.

d. A rolling deficiency log will be developed and issued to the Owner and Design Team for appropriate action.

e. The Commissioning Agent will retest deficiencies one time when notified in writing by the appropriate Contractor that corrective actions were taken. The Contractor shall meet on site with the Commissioning Agent to verify the items noted on the deficiency log are complete.

1) The Commissioning Agent will notify the Design Team, Owner and Contractor of retesting required by issuing an Additional Services Notification.

(a) If additional Commissioning Agent testing is required, a deduct change order will be processed to the Contractor(s) to cover the additional testing incurred by the Owner, from the Commissioning Agent.

f. Seasonal testing may be required if ambient weather conditions do not allow for reasonable testing conditions during the initial functional testing phase to place heating or cooling systems under full load.

g. It is the Contractor's responsibility to ensure that all system, equipment and component warranties remain in place throughout the startup, commissioning, and training process. The Contractor or Supplier will notify the Owner's Representative in writing if the proposed commissioning activities endanger warranties.

h. The Contractor shall be responsible for maintaining the Project Record Documents as outlined elsewhere in the contract documents. The Contractor shall record adjustments, changes, and clarifications made during the startup, commissioning and training processes.

I. Training Coordination:

1. The Commissioning Agent will assist the Construction Team to organize and coordinate training. Training is the responsibility of the Construction Team including scheduling factory authorized personnel where required. The Commissioning Agent will work with the Contractors to ensure training is complete and meets the needs of the Owner.

a. Refer to Section 01 79 00 - Demonstration and Training.

2. The Construction Team shall provide an instructional program to the Commissioning Agent for review prior to the start of training. The program shall include the following:

a. List of each building component and equipment for which the Owner is to receive training.

b. Proposed schedule including dates and times. The specific planned duration shall be noted.

c. Instructors name and contact information.

d. Recommended names and Owner' group required for attendance.

3. The Construction Team shall maintain an attendance record and submit to the Commissioning Agent upon completion of all training.

3.04 FIELD TESTING AND COMMISSIONING OF PARTITIONS FOR NOISE ISOLATION

A. Commissioning Agent Responsibilities:

1. Conduct testing of partitions requiring a specific STC class indicated on drawings and/or in various specifications sections. Comply with ASTM E336 for testing methods, including requirements of Annex A1 for reduction of flanking sound transmission.

2. Confirm that the FSTC values are not less than 67 percent of design STC values.

3. Re-test deficiencies after correction by the Contractor.

B. Contractor(s) Responsibilities:

1. Correct deficiencies and notify the Commissioning Agent when complete and ready for re-testing.

a. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

b. Sealants for remedying flanking sound transmission deficiencies evidenced as excessive air leakage are specified in Section 09 21 16 - Gypsum Wallboard Assemblies.

END OF SECTION 01 91 13

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition .
B. Selective demolition of building elements for alteration purposes.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Schedule indicating proposed sequence of operations for selective demolition work to Owner's Representative/Construction Manager for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control.
C. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
    1. Coordinating with the Owner’s continuing occupation of portions of existing building and with Owner’s partial occupancy of completed new construction areas.
D. Landfill records for record purposes indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.03 BUILDING DEMOLITION JOB CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of work.
B. Owner assumes no responsibility for actual condition of buildings to be demolished.
    1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as practical.
C. Asbestos: Asbestos is maybe present in the building or structure to be demolished. A report on the presence of asbestos is on file for review and use.
    1. If asbestos is encountered, the Owner will be responsible for removal.
D. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
    1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
E. Use of explosives will not be permitted.
F. Environmental Controls: Use temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
    1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution, or damage to finishes or occupied spaces.
G. Lead Containing Materials: The existing building may contain lead-containing materials, including lead paint. It is the Contractor's responsibility to meet all governmental regulations when dealing with and disposing of lead containing materials.
H. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving structures to be demolished.
    1. Arrange to shut off indicated utilities with utility companies.
    2. Utility Requirements: Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
I. Storage or sale of removed items or materials on-site will not be permitted.

1.04 SELECTIVE DEMOLITION JOB CONDITIONS

A. Occupancy: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner’s normal operations. Provide minimum of 72 hours advance notice to Owner’s Representative of demolition activities that will affect Owner’s normal operations.
B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.
    1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage

operations prior to start of selective demolition work.

C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
   1. Storage or sale of removed items on site will not be permitted.

D. Protection: Provide temporary barricades and other forms of protection to protect Owner's personnel, students and general public from injury due to selective demolition work.
   1. Coordinate protective measures with those to be performed or constructed for asbestos abatement work. Avoid duplication of work where practical.
   2. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to occupied portions of building.
   3. Erect temporary covered passageways as required by authorities having jurisdiction.
   4. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
   5. Protect from damage existing finish work that is to remain in place and which becomes exposed during demolition operations.
   6. Protect floors with suitable coverings when necessary.
   7. Construct temporary insulated dustproof partitions where required to separate areas where noisy, dirty or dusty operations are performed. Construct partitions out of metal stud, poly and gypsum board and provide dustproof doors and security locks.
   8. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

E. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

F. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
   1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

G. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, flame cutting will not be allowed. Maintain portable fire suppression devices during flame-cutting operations.

H. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
   1. Do not interrupt utilities serving occupied or used facilities or spaces, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.
   2. Maintain fire protection services during selective demolition operations.
   3. Maintain HVAC functions in occupied spaces, in so far as possible. Provide temporary heating and ventilation as required to maintain acceptable working conditions. Do not interrupt functions to occupied spaces, except as shown on the demolition plans or when authorized in writing by the Owner.

I. Environmental Controls: Use temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
   1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution, or damage to finishes or occupied spaces.

J. Do not use highly odoriferous, hazardous or highly volatile chemicals during demolition without the approval of the Owner. Provide appropriate safeguards during the use of such approved materials.

K. Lead Containing Materials: The existing building may contain lead-containing materials, including lead paint. It is the Contractor's responsibility to meet all governmental regulations when dealing with and disposing of lead containing materials.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required, of similar size of project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Pre-demolition Conference: Conduct conference at project site to comply with pre-installation conference requirements of Division 1.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove the portions or entire building as noted on the drawings.

1. Demolish and remove buildings, concrete footings, foundations, slabs, masonry and concrete walls, steel framing, stairs, ramps and elevator, plaster and drywall partitions, flooring ceilings, floor and roof structure, fixed equipment and casework, doors, windows, brick, roofing, electrical and mechanical equipment. Building demolition include retaining walls and planters attached to buildings and stoops at entry doors.
2. Removal and legal disposal of all PCB-containing light fixture ballasts and other miscellaneous PCB-containing equipment.
3. Removal and legal disposal of all light bulbs, thermostats, batteries and other items containing mercury, lead or cadmium.
4. Removal, stabilization and legal disposal of all peeling and flaking lead-based paint.
5. Removal and legal disposal of items that may contain oil, R-22 refrigerant, hydraulic oil, boiler chemicals, fire extinguishing agents, and ammonia.

B. Selective removal of portions of existing building indicated on drawings and as required, to be removed and disposed of off site, to accommodate new construction.

1. Removal and protection of existing fixtures, materials, and equipment items indicated “salvage.”

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Demolish buildings completely and remove from the site. Use methods required to complete work within limitations of governing regulations and as follows:

1. Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
2. Dispose of demolished items and materials promptly. On-site storage for sale of removed items is prohibited.
3. Demolish concrete and masonry in small sections
4. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
5. Break up and remove concrete slabs on grade, unless otherwise shown to remain.
6. Remove air-condition equipment without releasing refrigerants.
7. Below-Grade Construction: Demolish foundation walls and other below-grade construction, as follows:
    a. Completely remove below-grade construction, including foundation walls and footings.
    b. Break up and remove below-grade concrete slabs.
8. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.
9. Crushing of concrete on site will be allowed. Crush concrete used for fill on site to Class V gradation.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
3. Provide, erect, and maintain temporary barriers and security devices.
4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
7. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.

8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
9. Provide for effective air and water pollution controls as required by local authorities having jurisdiction.

C. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.

D. Do not begin removal until receipt of notification to proceed from Owner, the Owner's Designated Representative or the Construction Manager.

E. Do not begin removal until built elements to be salvaged or relocated have been removed.

F. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.

G. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

H. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

I. If hazardous materials are discovered during removal operations, stop work and notify General Contractor or Construction Manager and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury. Follow the following procedures:
1. If the materials are not disturbed, stop work in the immediate area and notify the Owner/Construction Manager who will arrange for abatement of the material.
2. If the material has been disturbed by demolition operation, or is otherwise loose or damaged, evacuate the immediate area and restrict access to all personnel. Shut off or isolate HVAC to the area. Notify the Owner/Construction Manager and do not re-enter space until abatement is complete and permission has been received.
3. Rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

J. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
1. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

K. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Dismantle existing construction and separate materials.
2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
1. Verify construction and utility arrangements are as indicated.
2. Report discrepancies to General Contractor or Construction Manager before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

C. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools.

D. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

E. Prior to any floor slab cutting and removal, contractor to identify any and all underground mechanical and electrical items by means such as, but not limited to: X-ray, ground penetrating radar, tracing, etc. Any damage will be replaced at expense of Contractor. Contractor must give General Contractor or Construction

Manager 48 hour notice prior to any floor slab cutting.

F. Separate areas in which demolition is being conducted from areas that remain occupied.
   1. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
      a. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 3-5/8" metal studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with insulation. Provide lockable dustproof doors.
      b. Provide similar weatherproof closures for exterior openings resulting from or immediately adjacent to demolition work.

G. Remove existing work as indicated and required to accomplish new work.
   1. Carefully remove, clean and salvage items indicated on drawings.
      a. Furniture/building contents, not scheduled for reuse, remain property of Owner. Notify Architect if such items are encountered and obtain approval regarding method of removal and salvage for the Owner.
      b. Store salvaged items to be reused off the ground in a clean, dry location, away from uncured concrete or masonry. Cover with waterproof material in a manner that permits air circulation within covering.
      c. For items to be reused, inventory, label with previous location and new location.
   2. Leave all surfaces and work ready and acceptable to the next trade. Use only materials and techniques that are acceptable to subsequent trades to remove materials from surfaces to remain.
      a. Remove adhesive and other materials where wall and floor coverings are removed.
   3. Patch or repair demolition in excess of that shown on drawings.

H. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extend of the conflict. Submit report to General Contractor or Construction Manager in written, accurate detail. Pending receipt of directive from Architect, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
   1. Cease operations and notify Architect, General Contractor or Construction Manager immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

I. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
      a. Patch to match new work.

3.04 DEBRIS, WASTE REMOVAL AND CLEANUP

A. Remove debris, junk, and trash from site.

B. Remove and legally dispose of off site, all materials not to be reused on site; do not burn or bury.
   1. Disposal of all PCB-containing light fixture ballasts and other miscellaneous PCB-containing equipment, items containing mercury, lead or cadmium, oil, R-22 refrigerant, hydraulic oil, boiler chemicals, fire extinguishing agents and ammonia is the responsibility of the Contractor. The Contractor shall carefully remove all such equipment and place it in containers and deliver to a certified hazardous waste disposal service and/or a certified hazardous lamp recycling service. The Contractor shall provide the Owner with certified documentation that these items have been legally disposed of.

C. Remove protection when no longer required by demolition and remodeling work.

D. Leave site in broom clean condition, ready for subsequent work.

E. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 41 00

SECTION 02 69 00
REMOVAL OF ABANDONED WELL/SEPTIC SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The removal and capping of an:
   1. Abandoned well.
   2. Removal of septic system.

B. The application for the obtaining of all necessary permits including the payment of permit fees.

1.02 QUALITY ASSURANCE

A. Licensing and Permits
   1. Obtain abandonment permit from the County.
   2. Only contractors currently licensed by the Minnesota Department of Health may apply for and obtain an abandonment permit.
   3. Contractor may be required to provide a separate surety bond indemnification agreement and a certificate of insurance to the County prior to obtaining a permit. A performance bond may also be required as a condition of the permit.
   4. All fees for licensing, permits and Bonds shall be paid by the Contractor.

B. Additional Requirements
   1. The Contractor shall measure and report the static water level prior to sealing the well.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Well Abandonment Records: Recording location of abandoned well or bore hole. Before equipment is removed from the site, the exact location of the abandoned hole shall be determined and recorded, "tying in" the location with permanent reference points, or as prescribed by the appropriate jurisdiction. All information relative to the abandonment procedures and the location of the abandoned well shall be prepared and assembled as prescribed by the appropriate jurisdiction, with copies supplied to the respective agency and the Owner of the land.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete
   1. Portland Cement: ASTM C150, Type I or Type III.
   2. Aggregates: Normal weight - ASTM C33.
   3. Water: Clean, potable, free from oil, acid and deleterious amounts of alkalis or organic material.

B. Sand and Gravel: Dimensionally stable, disinfected, free of clays and organic materials.

2.02 GROUT

A. Concrete Grout: A mixture or Portland cement (ASTM C150), sand, coarse aggregate and water in the proportion of at least five (5) bags of cement per cubic yard of concrete to not more than seven (7) gallons of clean water per bag of cement (one cubic foot or 94 pounds) shall be used. The use of special cements, bentonite to reduce shrinkage or other admixtures (ASTM C494) to reduce permeability, increase fluidity, and/or control time of set, and the composition of the resultant slurry must be approved by permit.

B. Sand Cement Grout: A mixture or Portland cement (ASTM C150), sand and water in the proportion of not more than two parts by weight of sand to one part of cement with not more than seven (7) gallons of clean water per bag of cement (one cubic foot or 94 pounds) shall be used. The use of special cements, bentonite to reduce shrinkage or other admixtures (ASTM C494) to reduce permeability, increase fluidity, and/or control time of set, and the composition of the resultant slurry must be approved by permit.

C. Neat Cement Grout: A mixture or Portland cement (ASTM C150), and not more than seven (7) gallons of clean water per bag of cement (one cubic foot or 94 pounds) shall be used. The use of special cements, bentonite to reduce shrinkage or other admixtures (ASTM C494) to reduce permeability, increase fluidity, and/or control time of set, and the composition of the resultant slurry must be approved by permit.

D. Disinfecting Compounds: Sodium hydrochloride or calcium hyperchlorite dissolved in water to produce 100 ppm available chlorine in double the amount of water in the well.

E. Temporary Bridges: Inorganic materials or patented devices containing expandable neoprene, plastic, and other elastomers specifically designed for use in well construction.

PART 3 EXECUTION

3.01 EXAMINATION OF PROJECT CONDITIONS

A. Prior to abandonment and demolition, examine the project conditions required to execute the work of this section.

3.02 ABANDONMENT

A. The procedures below shall be followed unless the abandonment permit contradicts, and in that the case the permit requirements shall be followed.
   1. Preparation
      a. Remove all materials from the well which may hinder its proper abandonment.
      b. Select methods and materials only after a detailed study of both the well and geohydrology.
      c. Choose materials and methods that will afford the greatest probability for successful sealing.
   2. Placement of Grout
      a. Concrete, sand-and-cement grout, or cement grout used as a sealing material in abandonment operations shall be introduced at the bottom of the well or interval to be sealed (or filled) and placed progressively upward to the top of the well. All such sealing materials shall be placed by the use of grout pipe, tremie, cement bucket or dump bailer, in such a way as to avoid segregation or dilution of the sealing materials. Dumping grout material from the top shall not be permitted. Seals intended to prevent vertical movement of water in the well or bore hole shall be composed of cement, sand-and-cement, or concrete; except that where such seals must be placed within casing or liners, only neat cement group may be used. The cement water ratio shall be that specified in Part 2C. Cement seals shall be placed by means of pumping through drop pipe or by use of a dump bailer, with placement beginning at the bottom and continuing upward. The minimum cement seal length, wherever dimensions permit, shall be 10 feet.
      b. Intermediate Seals: Intermediate seals of cement, sand-and-cement, or concrete shall be placed in impermeable strata between aquifers which are identifiable as, or are suspected of being, hydraulically separated under natural, undisturbed conditions. Once the required cement seal has been installed, the remainder of the impermeable zone or non-producing zone between aquifers shall be filled with sand, sand and gravel, or cement-bearing mineral materials.
      c. Seal at Uppermost Aquifer: A cement, sand-and-cement, or concrete seal shall be installed in the least permeable zone immediately above the uppermost water-producing zone. Such seals shall be placed only in quiescent (non-flowing) water.
      d. Seals Placed Within Casing, Liners, Filters, etc.: Seal which must be placed in casing, liners or filters require special attention. The material between the well and the face of the bore hole shall be thoroughly perforated, ripped, or otherwise disintegrated as the necessary first step. Neat cement only, or neat cement with a maximum of 5 percent by weight of commercially processed bentonite clay, shall be used as the seal. Either of two methods may be used.
         1) The calculated amount of grout required to fill the well interval plus the annular space outside the lining shall be placed within the space to be cemented, running the cement through a special cementing packer manufactured for this purpose and installed immediately above the perforated or ripped zone. The cement shall be injected at a pressure calculated to be at least 50 psi greater than the normal hydrostatic pressure within the well at the point of injection.
         2) The calculated amount of cement grout required to fill the casing interval plus the annular space outside the lining, plus sufficient cement grout to fill an additional 10 feet of the lining, shall be introduced at the bottom of the interval to be cemented.

B. Septic System Removal:
   1. Follow the requirements required by the appropriate jurisdiction.

C. Placement of Fill - Non-Producing Zones: Non-producing zones above the aquifer shall be filled with stable materials such as sand, sand and gravel, cement, cement and sand, or concrete. Non-producing zones above the uppermost aquifer seal shall be filled with materials less permeable than the surrounding undisturbed formations. The uppermost 5 feet of the borehole (at land surface) shall be filled with a material appropriate to the intended use of the land.

END OF SECTION 02 69 00

SECTION 03 30 13
CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.
B. Interior and Exterior slabs on grade.
C. Concrete reinforcement.
D. Miscellaneous concrete elements, including equipment pads and grout for masonry lintels, bond beams and block cores.
E. Concrete curing.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
C. Mix Design: Submit proposed concrete mix design.
    1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
    2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.

1.03 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
B. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Slabs with Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.
C. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
    1. Provide warranty by admixture manufacturer matching terms of flooring adhesive or primer manufacturer's material defect warranty.

PART 2 PRODUCTS

2.01 FORMWORK

A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
    1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
B. Slab Reinforcement:
    1. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
    2. Synthetic Micro Fiber Reinforcement: Add to mix as recommended by manufacturer for specific project conditions. Minimum rate of 1.5 pounds per cubic yard. Minimum residual strength per ASTM C1399 or C1609: 45 psi.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
B. Fine and Coarse Aggregates: ASTM C33/C33M.
C. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
B. Air Entrainment Admixture: ASTM C260/C260M.
C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
D. Accelerating Admixture: ASTM C494/C494M Type C.

E. Water Reducing Admixture: ASTM C494/C494M Type A.

F. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs). Closes capillary systems formed during concrete curing to reduce moisture vapor emission and transmission. Reduces concrete shrinkage with no adverse effect on concrete properties or applied flooring.

1. Provide admixture in slabs.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Provide products specified in Section 07 21 00 Insulation.

B. Self-Leveling Cementitious Concrete Floor Topping:

1. Approved manufacturers/products: Sonneborn: Sonoflow; Thoro: Underlayment – self-leveling; Ardex: K-15; L&M Construction Chemicals: Levelex; Euclid Chemical Company: Flo-Top or Super Flo-Top; HPS North America: Schönox ZM; W.R. Meadows: Floor-Top STG; USG: Durock UltraCap.

2.06 CURING MATERIALS

A. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Clear, liquid sealer for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.

1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
3. VOC Content: Less than 100 g/L.

B. Moisture-Retaining Sheet: ASTM C171.

1. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch (0.102 mm).

2.07 CONCRETE MIX DESIGN

A. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

B. Normal Weight Concrete (Interior Slabs):

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch (27.6 MPa).
2. Synthetic Micro Fiber Reinforcement: Add to mix as recommended by manufacturer for specific project conditions. Minimum rate of 1.5 pounds per cubic yard. Minimum residual strength per ASTM C1399 or C1609: 45 psi.
3. Moisture Vapor Reduction Admixture (MVRA); Add to mix as recommended by manufacturer for specific project conditions.
4. Water-Cement Ratio: Maximum 0.45 by weight.
5. Maximum Aggregate Size: 3/4 inch (19 mm).
6. Maximum 28-day shrinkage per ASTM C157: 0.05%
7. Maximum Chloride Ion Content: 30 percent by weight of cement.

C. Normal Weight Concrete (Exterior Concrete):

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 5,000 pounds per square inch (34.5 MPa).
2. Synthetic Micro Fiber Reinforcement: Add to mix as recommended by manufacturer for specific project conditions. Minimum rate of 1.5 pounds per cubic yard. Minimum residual strength per ASTM C1399 or C1609: 45 psi.
3. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.
4. Water-Cement Ratio: Maximum 0.40 by weight.
5. Total Air Content: 4-1/2 to 7-1/2 percent, determined in accordance with ASTM C231.
6. Maximum Aggregate Size: 3/4 inch (19 mm) Class 5S.
7. Maximum 28-day shrinkage per ASTM C157: 0.05%
8. Maximum Chloride Ion Content: 15 percent by weight of cement.

D. Normal Weight Concrete (Masonry Core Fill, Bond Beams, Lintels and Pilasters):

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch (20.7 MPa).
2. Water-Cement Ratio: Maximum 0.45 by weight.
3. Maximum Aggregate Size: 3/8 inch (9.525 mm) Class 1S.
4. Maximum Chloride Ion Content: 15 percent by weight of cement.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Interior Slabs on Grade: Install vapor barrier under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
   1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.04 HOT WEATHER CONCRETING

A. Apply recommended practices of ACI 305R when wind, temperature and humidity conditions cause evaporation rates (using Figure 2.1.5 of ACI 305R) exceeding the following:
   1. 0.2 lb/sq ft/hr for concrete with Portland cement only.
   2. 0.1 lb/sq ft/hr for concrete with Portland cement and fly ash.
   3. 0.05 lb/sq ft/hr for concrete with Portland cement and silica fume.

B. Determine and document expected evaporation rate for the duration of concrete pour.

C. Wet or fog forms and reinforcing immediately prior to placement to bring temperature to ambient conditions.

D. Maintain surface moisture during the period immediately after placement and before final finishing by using wind breaks, fog sprayers, evaporation retarders, or shade (individually or in combination) to prevent plastic shrinkage cracking.

E. Use evaporation retarders according to manufacturer's instructions. Do not use as a finishing aid.

3.05 COLD WEATHER CONCRETING

A. Concrete placed during cold weather shall conform to the requirements of ACI 306.1.

B. Cold weather is defined as 3 or more successive days when the average daily outdoor temperature is less than 40 degrees F.

C. All surfaces, including subgrade and reinforcing larger than a #8 bar shall be above 35 degrees F. prior to placing concrete. All reinforcing bars #8 and smaller shall be above 10 degrees F. prior to placing concrete. Surfaces shall not be more than 10 degrees warmer than the minimum concrete temperatures required by ACI 306.1.

D. Maintain cold weather protection for the following duration but not less than the duration specified in "Curing and Protection" above:
   1. Maintain protection for a minimum of 48 hours after placement of concrete.
   2. Maintain protection for columns and supported slabs until at least 4 field cylinders, prepared and cured in accordance with ASTM C31, reach 85 percent of the specified 28-day strength, or, laboratory cured cylinders reach the specified 28-day strength.

E. Submit detailed procedures for cold weather concreting for engineer's information only.

F. Follow recommended practices of ACI 306R. Subject to other requirements of this section, a non-chloride accelerator may be used to normalize initial set and for early strength gain

3.06 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

3.07 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.

3.08 SELF-LEVELING CEMENT BASED UNDERLAYMENT

A. Clean surface of oil, grease, dirt, dust, curing compounds and laitance to sound concrete and according to manufacturer's written instructions. Apply primer as recommended by manufacturer.

B. Mix in accordance with manufacturer's instructions. Add aggregate if required due to underlayment thickness.

C. Pour over substrate and spread per manufacturer's instructions.

D. Protect from foot traffic until underlayment is fully cured.

3.09 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:

1. Troweled Finish:
    a. F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
    b. F(L): Specified Overall Value of 20; Minimum Localized Value of 12.
2. Broom Finish: Moderately flat tolerance.
    a. F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
    b. F(L): Specified Overall Value of 20; Minimum Localized Value of 12.

B. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

C. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.10 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:

1. Interior: "Steel trowel" as described in ACI 302.1R.
2. Exterior: "Broom Finish".

3.11 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Surfaces Not in Contact with Forms:

1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Final Curing: Begin after initial curing but before surface is dry.
    a. Moisture-Retaining Sheet: Lap strips not less than 3 inches (75 mm) and seal with waterproof tape or adhesive; secure at edges.
    b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

END OF SECTION 03 30 13

SECTION 05 40 00

COLD-FORMED METAL FRAMING (NON-WOLD MASTER - FOR REFERENCE ONLY)

PART 2 PRODUCTS

1.01 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

1.02 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

1.03 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

END OF SECTION 05 40 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes: All labor, material necessary to complete all items of miscellaneous metal as listed on the schedule in Part 2 and shown on the Drawings.

B. The design, fabrication, transportation to the project site, and associated operations required to complete miscellaneous metals, including all the various metal items manufactured to more or less standard details in sizes conforming to specific requirements of the project.

C. Shop fabricated steel, aluminum, and galvanized and stainless steel items.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Design data: Submit drawings and supporting calculations, signed and sealed by a licensed professional structural engineer (PE) in the State the project is located.
    a. Metal railings, stairs, catwalks, ladders, and other items specified in this section shall be designed to resist self-weight and the more stringent of:
        1) Superimposed Dead and Live Loads indicated on the Contract Documents, and
        2) Loads set forth by the governing Building Code.
    b. The maximum Live Load deflection shall be L/360. Deflection determined based on structural section(s) alone
3. Coordinate work with other suppliers and subcontractors; obtain their approved shop drawing where necessary, or obtain any necessary additional detail information regarding mounting conditions or other aspects of related work.

1.03 QUALITY ASSURANCE

A. Design under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Stainless Steel, General: ASTM A666, Type 304 or 302.

F. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch (1.59 mm) minimum metal thickness, 1-1/2 inch (38 mm) diameter.

G. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

H. Slotted Channel Fittings: ASTM A1011/A1011M.

I. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

J. Expansion and Adhesive Anchors:

1. Wedge Anchors: Hilti "Kwik Bolt II" or Ramset/Redhead "Trubolt" or equal.
2. Heavy Duty Sleeve Anchors: Hilti "HSL" or equal.
3. Adhesive Anchors: Hilti "HVA" or "HIT", Ramset/Redhead "EPCON" or equal.

K. Bolts, Nuts, and Washers: Appropriate for the materials being connected.

L. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

M. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

N. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
C. Bolts, Nuts, and Washers: Stainless steel.
D. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 MATERIALS - OTHER

2.04 FABRICATION

A. Take field measurements before fabrication when required.
B. Fit and shop assemble items in largest practical sections, for delivery to site.
C. Fabricate items with joints tightly fitted and secured.
D. Continuously seal joined members exposed in the work by continuous welds and grinding smooth.
E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
H. In all areas of exposed steel that is to receive a finish:
    1. Piece marks hidden: Fabricate such that piece marks are fully hidden in the final structure or made with such media to permit full removal after erection.
    2. Mill mark removal: Deliver steel with no mill marks (stenciled, stamped, raised, etc) in exposed locations. Omit mill marks by cutting of mill material to appropriate lengths where possible. Where not possible, fill and/or grind to a surface finish consistent with the adjacent material.

2.05 SCHEDULE OF FABRICATED ITEMS

A. Items listed in this Section are intended only as a guide, but do not relieve responsibility for verifying quantities and inclusion of all similar items. Thoroughly examine all Drawings for items of miscellaneous metal fabrications.
    1. Ships ladders.
    2. Masonry knee wall supports and bracing of non-bearing masonry walls.
    3. Stainless steel ceiling hung demonstration bars in Physics Labs.
    4. Steel supports for gymnasium equipment.
    5. Steel supports for operable partitions and walls.
    6. Steel supports for glass sliding doors/walls.
    7. Steel lintels noted on the Architectural "Non-Bearing Wall Lintel Schedule".
    8. Pipe Bollards.
B. Bumper Posts: As detailed; prime paint finish.
    1. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
C. Not Attached to Structural Framing: For support of metal decking; prime paint finish.
    1. Lintels: As indicated on non-bearing lintel schedule; prime paint finish or galvanized when indicated.
D. Door Frames for Overhead Door Openings, Wall Openings, and Coiling Door Openings: Sections as indicated; prime paint finish.
E. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.
F. Other miscellaneous metal items shown on drawings.

2.06 FINISHES - STEEL

A. Prime paint steel items.
    1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
    2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
    3. Do not paint aluminum or stainless steel items, unless specifically called for on the drawings.
B. Prepare surfaces in non-public areas to be primed in accordance with SSPC-SP2.
C. Prepare surfaces in public areas to be primed in accordance with SSPC-SP6.
D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
E. Prime Painting: One coat.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements for all steel items exposed to weather.
G. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
H. Stainless Steel Finish: #4 Satin, ASTM A167.

2.07 FINISHES - ALUMINUM

A. Interior Aluminum Surfaces: Class I natural anodized.
B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.08 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.
B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Field weld components as indicated on shop drawings.
D. Perform field welding in accordance with AWS D1.1/D1.1M.
    1. Continuously weld field splices and grind smooth where exposed to view.
    2. Fill exposed splice joints with body filler and sand smooth
E. Obtain approval prior to site cutting or making adjustments not scheduled.
F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.
G. After erection, touch-up damaged hot dipped galvanizing.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.05 FIELD QUALITY CONTROL

A. Structural Testing and Special Inspection
    1. Comply with the requirements of Section 05 10 00 – Structural Steel Framing
    2. The Owner will employ a Special Inspector for the following:
        a. Visual inspect 100% of all fillet welds, for size, length, and quality, per AWS D1.1. Qualifications: Technical II.

END OF SECTION 05 50 00

SECTION 06 10 00
ROUGH CARPENTRY-WOOD FRAMED BUILDINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.
B. Nonstructural dimension lumber framing.
C. Rough opening framing for doors, windows, and roof openings.
D. Sheathing.
E. Building Wrap.
F. Rigid Wall Insulation.
G. Subflooring.
H. Underlayment.
I. Preservative treated wood materials.
J. Fire retardant treated wood materials.
K. Wall sheathing with factory applied water-resistive and air barrier sheet.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials.
C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

1.03 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
    1. Species: Douglas Fir-Larch, unless otherwise indicated.
    2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
    3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
    4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
B. Provide sustainably harvested wood; see Section 01 60 00 - Product Requirements (Non-Wold Master - For Reference Only) for requirements.
    1. Provide wood harvested within a 500 mile (805 km) radius of the project site.
    2. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.
        a. Where salvaged lumber is used for structural applications, provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc; www.alsc.org.
    3. Lumber fabricated from recovered timber is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Provide preservative-treated lumber for work exposed to moisture or indirect contact with concrete slabs.
B. Sizes: Nominal sizes as indicated on drawings, S4S.
C. Moisture Content: S-dry or MC19.

D. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):
   1. Species: Allowed under referenced grading rules.
   2. Grade: No. 2.

E. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm)):
   1. Machine stress-rated (MSR) as follows:
      a. Fb-single; minimum extreme fiber stress in bending: 1350 psi (9,300 kPa).
      b. E; minimum modulus of elasticity: 1,300,000 psi (8960 MPa).
   2. Species: Allowed under grading rules.
   3. Grade: No. 1 and Better.

F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: No. 2 or better.

2.03 STRUCTURAL COMPOSITE LUMBER

A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
   1. Columns: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published modulus of elasticity, E: 1,800,000 psi (12,410 MPa), minimum.
   2. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published modulus of elasticity, E: 1,800,000 psi (12,410 MPa), minimum.
   3. Headers Not Longer Than 48 inches (1220 mm): Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber.

2.04 CONSTRUCTION PANELS-BLOCKING

A. Meet APA C-D exterior, thickness as shown on Drawings.

2.05 CONSTRUCTION PANELS-SHEATHING

A. Subfloor/Underlayment Combination: PS 1 or PS 2 type, rated Single Floor.
   1. Bond Classification: Exterior.
   2. Span Rating: 24.
   3. Edges: Tongue and groove.

B. Subflooring: PS 2 type, rated Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 32/16.
   3. Performance Category: 3/4 PERF CAT.

C. Underlayment: APA Underlayment; plywood, Exposure 2, 1/2 inch (12.5 mm) thick. Fully sanded faces at resilient flooring.

D. Underlayment: Particleboard, ANSI A208.1, Grade PBU.

E. Roof Sheathing: Plywood, PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 24/16.
   3. Performance Category: 3/4 PERF CAT.

F. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
   1. Grade: Structural 1 Sheathing.
   2. Bond Classification: Exposure 1.
   3. Performance Category: 5/8 PERF CAT.
   4. Span Rating: 40/20.
   5. Edges: Square.
   6. Fire rated.
   7. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.

G. Wall Sheathing: PS 2 type.
   1. Bond Classification: Exterior.
   2. Grade: Structural I Sheathing.

3. Span Rating: 24/16 inch.
4. Performance Category: 5/16 PERF CAT.
5. Edge Profile: Square edge.

H. Wall Sheathing: Oriented strand board structural wood panel with factory laminated water-resistive barrier layer.
1. Sheathing Panel: PS 2, Exposure 1.
   a. Size: 4 feet (1219 mm) wide by 8 feet (2438 mm) long.
   b. Grade: Sheathing.
   c. Performance Category: 1/2 PERF CAT.
   d. Span Rating: 32/16.
   e. Edge Profile: Square edge.
2. Integral Water-Resistive Barrier: Sheet material qualifying as a Grade D water-resistive barrier; complying with ICC-ES AC310.
3. Water Vapor Permeance of Water-Resistive Barrier: 12 to 16 perms (689 to 918 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure B.
4. Maximum Allowable Air Leakage of Assembly: Comply with ASTM E2357.
   a. Infiltration: 0.0072 cfm/sq ft (0.037 L/s per sq m), maximum, at a pressure differential of 1.57 psf (75 Pa).
   b. Exfiltration: 0.0023 cfm/sq ft (0.012 L/s per sq m), maximum, at a pressure differential of 1.57 psf (75 Pa).
5. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.
6. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.
7. Warranty: Manufacturer's standard 30 year limited system warranty.
   a. Performance: Panel and tape resistance to water penetration; tape adhesion.
   b. Material: Free from manufacturing defects and panel delamination.
8. Manufacturers:
   a. Georgia-Pacific LLC; ForceField Air and Water Barrier System: www.buildgp.com.
   b. Huber Engineered Woods, LLC; ZIP System Roof/Wall Sheathing and ZIP System Seam Tape: www.huberwood.com.
   c. Louisiana-Pacific Corporation; WeatherLogic: www.lpcorp.com.

I. Wall Sheathing: Oriented strand board structural wood panel with factory laminated rigid plastic insulation board, and water-resistive barrier layer.
1. Sheathing Panel: PS 2, Exposure 1.
2. Insulation Board: Polyisocyanurate (ISO) insulation board; comply with ASTM C1289, Type II, Class 2 - Faced with coated polymer-bonded glass fiber mat facers on both major surfaces of the core foam.
3. Panel Thickness/R-Value:
   a. 1 inch (25.4 mm)/R-3.6.
   b. 1-1/2 inch (38.1 mm)/R-6.6.
   c. 2 inch inch (50.8 mm)/R-9.
   d. 2-1/2 inch (63.5 mm)/R-12.
4. Integral Water-Resistive Barrier: Sheet material qualifying as a Grade D water-resistive barrier; complying with ICC-ES AC310.
5. Water Vapor Permeance of Water-Resistive Barrier: 12 to 16 perms (689 to 918 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure B.
6. Maximum Allowable Air Leakage of Assembly: Complying with ASTM E2357, 0.04 cfm/sq ft (0.2 L/s sq m) at a pressure differential of 1.57 psf (75 Pa).
7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.
8. Edge Profile: Square.
9. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.
10. Warranty: Manufacturer's standard 30 year limited system warranty.
    a. Performance: Panel and tape resistance to water penetration; tape adhesion.

b. Material: Free from manufacturing defects and panel delamination.

11. Products:

a. Huber Engineered Woods, LLC; ZIP System R-Sheathing: www.huberwood.com.

2.06 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.

1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.

C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.

E. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.

1. Thickness: 68 mil, 0.068 inch (1.7 mm).
2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
3. Water Vapor Permeance: 0.035 perm (2 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.

F. Sill Flashing: See Section 07 62 00.

G. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed; adhesives designed for subfloor applications and complying with either ASTM C557 or ASTM D3498.

H. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.

I. Building Paper: Water resistant Kraft paper.

J. Rigid Wall Insulation: Refer to Section 07 21 00 Insulation for requiremnets.

K. Building Wrap: Refer to Section 07 21 00 Insulation for requirements.

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

PART 3 EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
C. Install structural members full length without splices unless otherwise specifically detailed.
D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
E. Provide the following specific nonstructural framing and blocking:
    1. Cabinets and shelf supports.
    2. Wall brackets.
    3. Handrails.
    4. Grab bars.
    5. Towel and bath accessories.
    6. Wall-mounted door stops.
    7. Chalkboards and marker boards.
    8. Wall paneling and trim.
    9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.
B. Subflooring: Glue and nail to framing; staples are not permitted.
C. Underlayment: Secure to subflooring with nails and glue.
    1. Place building paper between floor underlayment and subflooring.
D. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
    1. Nail panels to framing; staples are not permitted.
E. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
F. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
    1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
    2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
    3. Install adjacent boards without gaps.

G. Wall Sheathing and Roof Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs in accordance with manufacturer's installation instructions.
   1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
   2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
   3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
   4. Apply manufacturer's standard seam tape to joints between sheathing panels; use tape gun or hard rubber roller in accordance with manufacturer's installation instructions.

3.07 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.
C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.08 FIELD QUALITY CONTROL

A. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.
   2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

3.09 CLEANING

A. Waste Disposal: See Section 01 74 19 - Sustainable Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 00

SECTION 06 10 53
ROUGH CARPENTRY-WOOD BLOCKING

TURN OFF SPECIFIER NOTES
TURN OFF SUSTAINABILITY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Miscellaneous blocking, sleepers and nailers, shown on Drawings or required.
B. Curbs and blocking at roof. Wood blocking under coping and back sides of the parapet.
C. Blocking/sill sealer for anchorage of windows, storefront and entrances.
D. Blocking within gypsum wallboard partitions for support of markerboards, grab bars, toilet accessories, casework, hardware, other wall mounted specialties.
E. Exterior batt insulation within wood blocking at exterior windows and parapet blocking.
F. Preservative treated wood materials.
G. Fire retardant treated wood materials.
H. Communications and electrical room mounting boards.
I. Concealed wood blocking, nailers, and supports.
J. Miscellaneous wood nailers, furring, and grounds.
K. Blocking for Owner furnished Furniture, Fixtures and Equipment when noted on the drawings.

1.02 *SPECIFIER NOTE: KEEP BELOW FOR SUSTAINABLE PROJECTS.*

1.03 SUSTAINABILITY

A. ***SPECIFIER NOTE: Edit the proper Sustainable Guidelines you are using below.***
B. This project is governed by LEED Version 4.
   1. Refer to Section 01 81 13 - Sustainable Design Requirements - LEED.
C. This project is governed by Minnesota B3 Guidelines.
   1. Refer to Section 01 81 15 - Sustainable Design-Minnesota B3 Guidelines.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on fire retardant treated and preservative treated lumber.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, Hem-Fir, or Southern Pine.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
B. ***SPECIFIER NOTE: Keep all or part of the four items below for sustainable projects.***
C. Provide wood harvested within a 500 mile (805 km) radius of the project site.
D. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.
E. Lumber fabricated from recovered timber is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.
F. Metal strapping is acceptable to substitute for wood blocking for cabinets/casework, as follows:
   1. 20 gauge flat strap and backing plate sheet.
   2. Width: 6 inch.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Provide preservative-treated lumber for work exposed to moisture or indirect contact with concrete slabs.
   1. Preservative-treated lumber is not required for blocking that is protected by roofing membrane, peel and stick flashing or weather barrier.
B. Provide fire-retardant lumber for all interior and exterior framing and blocking with exception as follows:
   1. Blocking concealed in walls is not required to be fire-retardant lumber in construction types Type I and Type II buildings as noted on the Code Plan.
   2. ***SPECIFIER NOTE: Keep below for exception in Minnesota Code.***
   3. When blocking is 48" or less above the top of the structural roof deck, fire retardant lumber is not required in construction types Type I and Type II buildings as noted on the Code Plan.
C. Sizes: Nominal sizes as indicated on drawings, S4S.
D. Moisture Content: S-dry or MC19.
E. Blocking for sizes 2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm):
   1. Species: Douglas Fir-Larch, Hem-Fir or Southern Pine.
   2. Grade: No.2.
F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No.2 or Standard Grade.

2.03 CONSTRUCTION PANELS-BLOCKING

A. Electrical Room Mounting Boards: PS 1, A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
B. Communications Room Mounting Boards: PS 1, A-C plywood (void free), or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
C. Plywood blocking:
   1. Meet APA C-D exterior, thickness as shown on Drawings.
   2. Provide preservative-treated lumber for work exposed to moisture or indirect contact with concrete slabs, as shown on drawings.
      a. Preservative-treated lumber is not required for blocking that is protected by roofing membrane, peel and stick flashing or weather barrier.
   3. Provide fire-retardant lumber for all interior and exterior blocking.
      a. Blocking concealed in walls is not required to be fire-retardant lumber in construction types Type I and Type II buildings as noted on the Code Plan.
      b. ***SPECIFIER NOTE: Keep below for exception on Minnesota Code.***
      c. When blocking is 48" or less above the top of the structural roof deck, fire retardant lumber is not required in construction types Type I and Type II buildings as noted on the Code Plan.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.
B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
   1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.
C. Sill Sealer: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.
D. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.
E. Exterior Batt Insulation occurring with-in blocking of the exterior envelope: Refer to the requirements of Section 07 21 00 - Insulation.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A, using waterborne preservative to 0.10 lb/cu ft retention (to 1.6 kg/cu m retention).
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber exposed to weather.
      c. Treat lumber in contact with roofing, flashing, or waterproofing (Note: treated blocking is not required when covered with roofing material, peel and stick type flashing and weather barrier).
      d. Treat lumber in contact with masonry or concrete.
   2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with roofing, flashing, or waterproofing (Note: treated blocking is not required when covered with roofing material, peel and stick type flashing or weather barrier).
      c. Treat plywood in contact with masonry or concrete.
      d. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections (obtain product data, sizes and anchorage requirements from other trades prior to installation) including, but not limited to:
   1. Roofing applications as specified in Divisions 7, 22 and 23.
   2. Windows, storefront and curtainwall in Division 8.
   3. Miscellaneous specialties in Division 10.
   4. Blocking for hardware in Section 08 71 00.
   5. Furniture fixtures and equipment items furnished by the Owner and noted on the drawings.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific nonstructural framing and blocking:
   1. ***SPECIFIER NOTE: Add or delete from the list below to suit your project.***
   2. Cabinets and shelf supports.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall mounted baby changing tables.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

10. Door hardware.
11. Blocking for wall mounted technology items, i.e. Smartboards, Promethean boards and/or TV's.

F. Install sill sealer where indicated on drawings, including at window sills.

G. Install exterior batt insulation with-in blocking as noted on the drawings.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size: 48 by 96 inches (2440 by 4880 mm).
5. Coordinate with electrical/technology drawings and communications contractor on the requirements for installing panels.

3.06 CLEANING

A. Waste Disposal: See Section 01 74 19 - Sustainable Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 53

SECTION 06 16 43
GYPSUM SHEATHING

TURN OFF SPECIFIER NOTES
TURN OFF STANDARD GYPSUM SHEATHING
TURN OFF GYPSUM SHEATHING WITH WEATHER BARRIER
TURN OFF SUSTAINABILITY

PART 1 GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Glass-mat faced gypsum sheathing.
   2. ***SPECIFIER NOTE: The gypsum sheathing/weather barrier system below is sometimes used on residential style construction, like HCSL Senior Living projects. If regular gypsum sheathing is not used, delete sentence above.***
   3. Glass-mat faced gypsum sheathing with applied weather resistant barrier.
      a. Sealants and transition membranes.

1.02 *SPECIFIER NOTE: KEEP BELOW FOR SUSTAINABLE PROJECTS.*

1.03 SUSTAINABILITY

A. ***SPECIFIER NOTE: Edit the proper Sustainable Guidelines you are using below.***
B. This project is governed by LEED Version 4.
   1. Refer to Section 01 81 13 - Sustainable Design Requirements - LEED.
C. This project is governed by Minnesota B3 Guidelines.
   1. Refer to Section 01 81 15 - Sustainable Design-Minnesota B3 Guidelines.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   1. Product Data: Manufacturer's specifications and installation instructions for each product specified.

1.05 QUALITY ASSURANCE

A. Referenced Specifications: Current Gypsum Association Publications (www.gypsum.org).
B. 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.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling
   1. Deliver materials to the project site with manufacturer's labels intact and legible.
   2. Handle materials with care to prevent damage.
   3. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.
B. Storage
   1. Store materials under cover, stack flat, and off ground.

PART 2 PRODUCTS

2.01 GYPSUM SHEATHING

A. The following manufacturers/products are acceptable:
   1. Georgia-Pacific Gypsum LLC; DensGlass Gold Exterior Sheathing: www.gpgypsum.com.
   2. National Gypsum Company; Gold Bond Brande eXP Extended Exposure Gypsum Sheathing: www.nationalgypsum.com.
   3. USG Corporation; Securock Glass Mat Gymsum Sheathing: www.usg.com.
   4. Certain Teed Corporation; GlasRoc Sheathing: www.certainteed.com.
B. Panel Physical Characteristics
   1. Core: Regular gypsum core (Type X gypsum core at fire rated conditions) with additives to enhance moisture and mold resistance.
   2. Facing: Water-resistant glass mat on both face, back, and long edges.
   3. Overall thickness: 5/8 inch (15.875 mm).
   4. Panel complies with requirements of ASTM C 1177 (ASTM C1177, Type X at fire rated conditions).
   5. Racking strength – Ultimate: 540 lbs/sq.ft. (25.85534 kPa) dry when tested in accordance with ASTM E72.

6. Flexible Strength – Parallel: 80 lbs (36.2874 mm), when tested in accordance with ASTM C473.
7. Humidified Deflection: Not more than ¼ inch when tested in accordance with ASTM C473.
8. Nail Pull Resistance: 80 lbs, when tested in accordance with ASTM C473.
9. Water Absorption: Less than 10% when tested in accordance with ASTM C473.
10. Surface Water Absorption: Less than 1% when tested in accordance with ASTM C473.
11. Permeance: Greater than 10 perms (6.590 metric perms), when tested in accordance with ASTM E96.
12. R-Value: 0.40 (2.5 K) when tested in accordance with ASTM C518.
13. Combustibility: Noncombustible when tested in accordance with ASTM E136.
14. Flame spreads/smoke developed: 5/0 when tested in accordance with ASTM E84.
15. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273.

2.02 ***SPECIFIER NOTE: KEEP PARAGRAPH BELOW FOR COMBINATION GYPSUM SHEATHING AND WEATHER BARRIER. DELETE PARAGRAPH ABOVE IF NOT USED.***

2.03 GYPSUM SHEATHING WITH WEATHER RESISTANT BARRIER

A. Coated fiberglass mat gypsum sheathing with integral weather-resistant barrier.
   1. The following manufacturers/products are acceptable:
      a. Georgia-Pacific Gypsum LLC; DensElement Barrier Sheathing & DensDefy Barrier: www.gpgypsum.com.
      b. USG Corporation; Securock ExoAir 430 Panel & Tremco Sealants and Membranes: www.usg.com.

B. Panel and Barrier Physical Characteristics
   1. Core: Regular gypsum core (Type X gypsum core at fire rated conditions) with additives to enhance moisture and mold resistance.
   2. Facing: Water-resistant glass mat on both face, back, and long edges.
   3. Air Barrier:
      a. Air permeance of sheathing: Sheathing with an air permeability not greater than 0.001 cfm/ft2 (0.02L/s/m2) when tested in accordance with ASTM E2178.
      b. Air permeance of assembly: Assembly of sheathing and sealing components with an average air leakage not greater than 0.04 cfm/ft2 (0.2L/s/m2) when tested in accordance with ASTM E2357.
      c. Sealants and transition membranes: As recommended by manufacturer.
   4. Overall thickness: 5/8 inch (15.875 mm).
   5. Panel complies with requirements of ASTM C 1177 (ASTM C1177, Type X at fire rated conditions).
   6. Racking strength – Ultimate: 540 lbs/sq.ft. (25.85534 kPa) dry when tested in accordance with ASTM E72.
   7. Flexible Strength – Parallel: 80 lbs (36.2874 mm), when tested in accordance with ASTM C473.
   8. Humidified Deflection: Not more than ¼ inch when tested in accordance with ASTM C473.
   9. Nail Pull Resistance: 80 lbs, when tested in accordance with ASTM C473.
   10. Water Absorption: Less than 10% when tested in accordance with ASTM C473.
   11. Surface Water Absorption: Less than 1% when tested in accordance with ASTM C473.
   12. Permeance: Greater than 10 perms (6.590 metric perms), when tested in accordance with ASTM E96.
   13. R-Value: 0.40 (2.5 K) when tested in accordance with ASTM C518.
   14. Combustibility: Noncombustible when tested in accordance with ASTM E136.
   15. Flame spreads/smoke developed: 5/0 when tested in accordance with ASTM E84.
   16. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273.

2.04 ACCESSORIES

A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating have a salt-spray resistance of more than 800 hours according to ASTM B 117.
   1. For steel framing less than 0.0329 inch (0.83566 mm) thick, attach sheathing to comply with ASTM C 1002.
   2. For steel framing from 0.033 to 0.112 inch (0.8382 to 2.8448 mm) thick, attach sheathing to comply with ASTM C 954.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

3.02 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install boards with a 3/8 inch gap where non-load-bearing construction abuts structural elements.
   3. Install boards with a ¼ 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 boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach board at perimeter and within field of board to each steel stud.
   1. Space fasteners approximately 8 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 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

E. ***SPECIFIER NOTE: Keep below for combination gypsum sheathing and weather barrier.***

F. Weather barrier sealants and transition membranes: Install as recommended by the manufacturer.

END OF SECTION 06 16 43

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.
B. Standing and running trim.
C. Wood paneling.
D. Wood paneling wainscot.
E. Countertops.
F. Window stools/sills.
G. Wood ceilings.
H. Factory finishing.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
C. Product Data: Provide data for hardware accessories.
D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum ten years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   3. Single Source Responsibility: Provide and install this work from single fabricator.
B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org.
   2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   3. Provide designated labels on shop drawings as required by certification program.
   4. Provide designated labels on installed products as required by certification program.
   5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
   6. Replace, repair, or rework all work for which certification is refused.

1.05 MOCK-UPS

A. Provide mock-up of:
   1. Wood wainscot, approximately 3 feet (0.9144 m) wide by 10 feet (3.048 m) high, incorporating base, paneling, cover and acoustic panels by another section.
B. Locate where directed.
C. Mock-ups must be reviewed and accepted before remaining woodwork is fabricated/installed.
D. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firms that are members of AWI are acceptable.

B. Single Source Responsibility: Provide and install this work from single fabricator.

2.02 CABINETS

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

1. Cabinets as noted on the drawings:
    a. Finish - Exposed Exterior Surfaces: Decorative laminate.
    b. Finish - Exposed Interior Surfaces: Decorative laminate.
    c. Finish - Semi-Exposed Surfaces: Decorative laminate
    d. Finish - Concealed Surfaces: Manufacturer's option.
    e. Door and Drawer Front Edge Profiles: Square edge with PVC banding..
    f. Door and Drawer Front Retention Profiles: Fixed panel.
    g. Casework Construction Type: Type B - Face-frame.
        1) Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
    h. Adjustable Shelf Loading: 40 psf (19.5 gm/sq cm).
        1) Deflection: L/144.
    i. Cabinet Style: Flush overlay.
    j. Cabinet Doors and Drawer Fronts: Flush style.

2.03 STANDING AND RUNNING TRIM AND RAILS FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Grade: Custom.

C. Lumber Species: Any closed-grain hardwood listed in referenced woodworking standard.

D. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

E. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.04 FLUSH WOOD PANELING FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 500 and its Division 500A.

B. Grade: Premium.

C. Veneer Species: See Interior Material/Finish Color Schedule, on the Drawings.

D. Cut:

1. Plain Sliced.
2. Quarter Cut.
3. Rift Cut and Comb Grain.
4. Rotary Cut.

E. Matching of Adjacent Veneer Leaves: End match.

F. Veneer Matching Within Panel Face: Balance match.

G. Panel Matching Method: Match panels to one another within each separate area by the following method:

1. Sequence-matched panel sets.

H. Fire Performance Characteristics: Provide paneling composed of panels of wood veneer density and fire-retardant particleboard that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting organization on surfaces that will be concealed from view after installation.

1. Flame Spread: 75 or less.
2. Smoke Developed: 40 or less.

2.05 INTERIOR DOOR FRAMES FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 900B.

B. Grade: Premium.

C. Lumber Species: See Interior Material/Finish Color Schedule, on the Drawings.
D. Cut:
    1. Plain Sliced.
    2. Quarter Cut.
    3. Rift Cut and Comb Grain.
    4. Rotary Cut.
E. Fire-Rated Door Frames: Provide fire-rated wood frames for wood doors that are identical to units tested in door and frame assemblies per ASTM E152 and that are labeled and listed for ratings indicated by UL, Warnock Hersey, or other testing and inspection organization acceptable to authorities having jurisdiction.
    1. Fire ratings as scheduled on the Drawings and/or shown on Code Plans.

2.06 INTERIOR WOOD DOORS TO MATCH ADJACENT WOOD PANELS

A. Scope: Interior wood doors occurring in walls with wood paneling.
B. Quality Standard: Comply with AWI Section 1300-G.
C. Grade: Premium.
D. Match to Adjacent Wood Panel: Blueprint to match at wood paneled walls.
E. Finish: Factory prefinished to match adjacent wood panels.
F. Fabrication: Match requirements for solid core wood doors construction as specified in Section 08 14 16 “Flush Wood Doors”.
    1. Sizes as scheduled on the Drawings.
    2. Fire ratings as scheduled on the Drawings and/or shown on Code Plans.

2.07 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.08 PANEL CORE MATERIALS

A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
    1. Grade: M-2; moisture resistance: MR10.
B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
    1. Grade: 115; moisture resistance: MR10.
C. Basic Hardboard: Panel manufactured from inter-felted lignocellulosic fibers consolidated under heat and pressure; comply with ANSI A135.4.
    1. Class: Tempered.
    2. Surface: Smooth one side (S1S).

2.09 HARDWOOD PLYWOOD PANELS

A. Hardwood Plywood: Plywood manufactured for nonstructural decorative applications; consisting of faces and backs applied to a variety of core types; comply with HPVA HP-1.
    1. Woodwork Quality Standard: Panels complying with specified woodwork quality standard.
    2. Face veneer species and finish: See Interior Material Finish/Color Schedule.
        a. Grade: AA.
    3. Back: Balancing backer when not exposed.
    4. Core: Veneer, Particleboard or medium density fiberboard.

2.10 LAMINATE MATERIALS

A. Plastic Laminate: High Pressure Decorative Laminate (HPDL): NEMA LD 3, as follows:
    1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.
    2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.
    3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
    4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.
    5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.
    6. Colors/Textures: See Interior Material Finish/Color Schedule on the Drawings.
        a. A manufacturer listed in both the specification and the Interior Material Finish/Color Schedule, on the Drawings is not required to submit a pre-bid approval.
        b. Manufacturers listed in this specification, but not in the Interior Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval. Approval will be

listed by addendum.

c. When no colors are listed in the Interior Material Finish/Color Schedule, on Architectural Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

7. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005 (TFM allowed on casework interiors only.)
   a. Color: As selected from manufacturer's standard colors.

B. Provide specific types as indicated.
   1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color.
   2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color.
   3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch (1.0 mm) nominal thickness, through color.
   4. Post-Formed Vertical Surfaces: VGP, 0.028 inch (0.71 mm) nominal thickness, through color, _____ color, finish as indicated.
   5. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, through color, _____ color, finish as indicated.

2.11 COUNTERTOPS

A. Solid Surfacing Countertops: Solid surfacing sheet over continuous substrate of plywood.
   1. Configuration for exposed edges, back and end splashes, with details indicated on drawings.
   2. Fabricate in accordance with manufacturer's standard requirements.
   3. All countertop joints must be dry fit at the factory to check for consistency in color from one panel to the other and overall finished panel thickness, resulting in a high quality product easy to install.
   4. Colors:
      a. See Interior Material Finish/Color Schedule on the Drawings.
      b. A manufacturer listed in both the specification and the Interior Material Finish/Color Schedule, on the Drawings is not required to submit a pre-bid approval.
      c. Manufacturers listed in this specification, but not in the Interior Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval. Approval will be listed by addendum.

2.12 WINDOW STOOLS/SILLS

A. Painted Solid Wood Surfacing: Provide Custom quality hardwood
B. 1-1/8 inch (28.575 mm) thick, unless noted differently on the drawings.
C. Smooth finished edges, including exposed ends.
D. Solid Surfacing: Solid surfacing sheet over continuous substrate of plywood.
   1. 1-1/8 inch (28.575 mm) thick unless noted different on the drawings.
   2. For stools/sills over 7 feet (2.1336 m) in length, provide expansion joint with color match polyurethane or silicone sealant and backer rod at maximum of 8 foot (2.438 m) o.c.
      a. Submit shop drawings that identify each stool/sill and locate expansion joint for review by Architect.
   3. Colors:
      a. See Interior Material Finish/Color Schedule on the Drawings.
      b. A manufacturer listed in both the specification and the Interior Material Finish/Color Schedule, on the Drawings is not required to submit a pre-bid approval.
      c. Manufacturers listed in this specification, but not in the Interior Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval. Approval will be listed by addendum.

2.13 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
B. Plastic Edge Banding for Plastic Laminate: Extruded PVC, flat or convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
   1. Plastic-Laminate Countertops, backsplashes, open shelving, cabinet doors and drawers:
      a. 3MM PVC.
      b. Color: See Interior Material Finish/Color Schedule, on Drawings.
   2. Cabinet body and shelf/shelving edges:

3. 1 MM.
    a. Color matched to drawer/door/shelf face.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Adjustable Drawer Organization Systems: Drawer trays, dividers, and connectors.

G. Grommets: Standard painted metal grommets for cut-outs, in color to match adjacent surface.

2.14 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

C. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
1. Materials: Steel plates.
2. Products:
    a. A&M Hardware, Inc; Heavy-Duty Hybrid Brackets: www.aandmhardware.com or equal.

D. Fixed Standard Shelf, Countertop, and Workstation Brackets:
1. Material: Steel.
2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
3. Color: Selected by Architect from manufacturer's standard range.
4. Products:
    a. A&M Hardware, Inc; Standard Brackets: www.aandmhardware.com.

E. Fixed Handicapped Accessible-Compliant Vanity and Countertop Brackets:
1. Products:
    a. A&M Hardware, Inc; ADA Vanity Brackets: www.aandmhardware.com or equal.

F. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers ("U" shaped wire pull, steel with satin finish, 100 mm centers).

G. Sliding Door Pulls: Circular shape for recessed installation, steel with satin finish.

H. Cabinet Catches and Latches:
1. Type: Push latch.

I. Drawer Slides:
1. Type: Extension types as indicated.
2. Static Load Capacity: Heavy Duty grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.
6. Manufacturers:
    a. Accuride International, Inc; Heavy-Duty Drawer Slides: www.accuride.com or equal.

J. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
1. Manufacturers:
    a. Blum, Inc; CLIP top BLUMOTION: www.blum.com or equal.

K. Sliding Door Track Assemblies: Upper and lower track of satin anodized aluminum, with matching shoe equipped with nylon rollers.

2.15 SITE FINISHING MATERIALS

A. Finishing: Field finished, see Section 09 90 00.

2.16 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with plastic trim.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Provide center matched panels at each elevation.
   2. Provide sequence matching across each elevation.
   3. Carry figure of cabinet fronts to toe kicks.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 06 41 00

SECTION 07 01 50.19

PREPARATION FOR RE-ROOFING (NON-WOLD MASTER - FOR REFERENCE ONLY)

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 07 31 00 - Wood Shingle and Shake Roofing

1.02 FIELD CONDITIONS

A. Existing Roofing System: asphalt shingle roofing.

B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.

C. Maintain continuous temporary protection prior to and during installation of new roofing system.

D. Provide notice at least three days before starting activities that will affect normal building operations.

E. Verify that occupants have been evacuated from building areas when work on structurally impaired roof decking is scheduled to begin.

F. Owner will occupy building areas directly below re-roofing area.

1. Provide Owner with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
2. Do not disrupt Owner's operations or activities.
3. Maintain access of Owner's personnel to corridors, existing walkways, and adjacent buildings.

PART 2 PRODUCTS

2.01 COMPONENTS

A. See the following sections for additional information on components relating to this work:

1. Replacement and removal of existing roofing system in preparation for entire new roofing system, see Section 07 51 00.
2. Remove existing flashing and counterflashings in preparation for replacement of these materials as part of this work, see Section 07 62 00 for material requirements.

2.02 MATERIALS

A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.

B. Temporary Roofing Protection Materials:

1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

C. Roofing Recover Materials:

1. Contractor's responsibility to select appropriate materials for roofing re-cover as determined necessary for this work.

2.03 ACCESSORIES

A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

B. Roof Vent Pipe Extension: Solid-wall PVC fitting consisting of pipe and splice sleeve inserts, configured for insertion and sealing to existing plumbing vent piping, sized to fit inside diameter of plumbing vent piping, enabling extension of piping to field-determined height to meet local building code requirements for plumbing vent pipe height above existing roof level.

1. Manufacturers:
   a. Tubos Inc; Tubos Vent Extensions: www.tubos.biz/#sle.
   b. Substitutions: See Section 01 60 00 - Product Requirements (Non-Wold Master - For Reference Only).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials the same day.

B. Remove metal counter flashings.
C. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets, insulation vents, and _____.
D. Remove damaged insulation and fasteners, cant strips, and blocking.
E. Repair existing wood deck surface to provide smooth working surface for new roof system.

3.04 INSTALLATION

A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 07 51 00 for additional requirements.

3.05 PROTECTION

A. Provide protection of existing roofing system that is not having work performed on it.
B. Provide temporary protective sheeting over uncovered deck surfaces.
C. Provide for surface drainage from sheeting to existing drainage facilities.
D. Install recover board over existing membrane.

END OF SECTION 07 01 50.19

SECTION 07 05 53
FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification markings for rated partitions noted on the Code Plan.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.04 FIELD CONDITIONS

A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Partition Identification Labels:

1. Fire Wall Signs, Inc: www.firewallsigns.com.
2. Safety Supply Warehouse, Inc: www.safetysupplywarehouse.com.
3. Other manufacturers who meet the specification are acceptable.

2.02 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).

1. Lettering to be not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorportaing the rating of the wall noted on the Code Plan, i.e.: "2 HOUR FIRE BARRIER-PROTECT ALL OPENINGS".

B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl signs with factory applied adhesive backing.

C. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Locate labels as required by ICC (IBC) and at a minimum of within 15 feet at the end of each wall or corner and a maximum of 30 feet on center, both sides of partitions, above accessible ceiling line or below access floors. Provide at least one label per wall face.

1. Place above access panels at hard lid ceilings.

B. Install adhered markings in accordance with manufacturer's instructions.

C. Install neatly, with horizontal edges level.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION 07 05 53

SECTION 07 21 00
INSULATION

TURN OFF CAVITY WALL INSUL
TURN OFF EXT RIGID WALL/BONDED PLYWOOD INSUL
TURN OFF VAPOR BARRIER (WALL/ATTICS)
TURN OFF BUILDING WRAP
TURN OFF EXTERIOR BATT INSUL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Perimeter insulation used primarily on vertical surfaces below grade at foundation walls.
B. Cavity wall insulation used primarily as cavity wall insulation in masonry.
C. Rigid wall insulation/bonded plywood sheathing used primarily on exterior walls with wall finishes other than masonry.
D. Sound batt insulation used to control sound transfer in stud wall construction.
E. Expanding foam insulation as shown on drawings.
F. Vapor barriers used in combination with batt insulation in walls.
G. Vapor barriers used in combination with insulated attics.
H. Building wrap used primarily over wood exterior sheathing.
I. Exterior batt insulation occurring in exterior envelope.
J. Acoustic spray system to seal stud and masonry walls to structural deck.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on product characteristics, performance criteria, and product limitations for all specified products.
    1. For vapor barriers specifically provide:
        a. Manufacturer’s product samples and literature.
        b. Manufacturer’s installation instructions for placement, seaming and pipe boot installation.
    2. For Acoustic Spray System specifically provide:
        a. Installation data including application thickness of applied product.
C. Shop Drawings:
    1. Provide details of continuous semi rigid wall insulation and clip/sub-framing attachment.
    2. Drawings stamped by a Professional Engineer in the State the project is located that includes design of structural performance of clip and sub-framing anchorage, allowing for thermal loading and loading of components in accordance with applicable codes and regulations.

1.03 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.
B. Deliver material to the site in unopened packages, with identification labels intact.
C. Store under water-resistant cover and protect from weather and direct sunlight.
D. Remove damaged materials from site.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
    1. Type and Compressive Resistance: for perimeter insulation: Type IV, 25 psi (173 kPa), minimum.
        a. For perimeter insulation: Type IV, 25 psi (173 kPA), minimum.
    2. Products:
        a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com or equal.
    3. Cover at top of perimeter insulation: 0.125" painted or anodized aluminum sheet as detailed on drawings. Fasteners to be stainless or galvanized.
        a. Color: _____.
B. Cavity Wall Insulation:

1. Hunter Panels: www.hunterpanels.com; Xci Foil. Rigid closed cell polyisocyanurate foam corebonded on-line during a restrained-rise manufacturing process to trilaminate impermeable foil facers on both sides. Manufactured with HCFC-free blowing agent and is formaldehyde free. Insulation to comply with ASTM C1289 Type 1 and ASTM E85 Class B and NFPA 285 wall assembly.
    a. Thermal Resistance: Aged R-value per inch of 6.5.
    b. Moisture Vapor Permeance: 0.05 perm per inch per ASTM E96.
    c. Water Absorption: 0.05% by volume per ASTM C209.
    d. Surface Burning Characteristics: ≤75 flame spread and ≤450 smoke developed per ASTM E84.
    e. Compressive Strength: 25 psi per ASTM D1621.
    f. Size:16" X 8'-0".
2. This project is designed around an engineering evaluation #10123, Current Revision performed by Priest & Associates Consulting, LLC based on NFPA 285 Wall Assembly tests for Hunter Panels, provider of polyisocanurate continuous insulation as part of this assembly. Equivalent products by other manufacturers, must include and engineering evaluation and documentation that all other components of the evaluation match the specification (i.e. spray-foam, weather barrier, etc). Substitution requests without this information will not be reviewed. Refer to Section 01 25 00, Substitution and Product Options for substitution requirements.

C. Rigid Wall Insulation (Bonded Plywood):
1. Hunter Panels; www.hunterpanels.com; Xci Ply. Rigid closed cell polyisocyanurate foam core bonded to premium performance coated fiberglass facers on one side and ¾" fire treated plywood on the other. Manufactured with HCFC-free blowing agent and is formaldehyde free. Insulation to comply with ASTM C 1289 Type V made with Type II Class 2 foam and NFPA 285 wall assembly.
    a. Thermal Resistance: Aged R-value at 6 per inch (25.4 mm) of insulation plus an R-value of 0.94 for the plywood.
        1) Nominal 1 inch (25.4 mm) insulation plus plywood = R-value of 7.0.
        2) Nominal 1.5 inch (38.1) insulation plus plywood = R-value of 10.0.
        3) Nominal 2 inch (50.8 mm) insulation plus plywood = R-value of 13.1.
        4) Nominal 2.5 inch (63.5 mm) insulation plus plywood = R-value of 16.3.
        5) Nominal 3 inch (76.2 mm) insulation plus plywood = R-value of 19.5.
        6) Nominal 3.5 inch (88.9 mm) insulation plus plywood = R-value of 22.7.
        7) Nominal 4 inch (101.6 mm) insulation plus plywood = R-value of 26.0.
    b. Moisture Vapor Permeance: <1 perm per inch per ASTM E96.
    c. Water Absorption: 0.1% by volume per ASTM C209.
    d. Surface Burning Characteristics: ≤25 flame spread and ≤450 smoke developed per ASTM E84.
    e. Compressive Strength: 20 psi per ASTM D1621.
    f. Dimensional stability: 2% linear change (7 days) per ASTM D 2126.
    g. Resistance to mold: Passed ASTM D 3273.
    h. Size: 4' x 8'.
    i. Through insulation fasteners to back-up as recommended by manufacturer.
2. This project is designed around an engineering evaluation #10123, Current Revision performed by Priest & Associates Consulting, LLC based on NFPA 285 Wall Assembly tests for Hunter Panels, provider of polyisocanurate continuous insulation as part of this assembly. Equivalent products by other manufacturers, must include and engineering evaluation and documentation that all other components of the evaluation match the specification (i.e. spray-foam, weather barrier, etc). Substitution requests without this information will not be reviewed. Refer to Section 01 25 00, Substitution and Product Options for substitution requirements.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Exterior Envelope:
1. Unfaced lightweight, semi-rigid stone or mineral wool insulation produced by combining thermosetting resins with mineral fibers manufactured from glass, glas, wool or rock wool.
2. Density: 4.0 lbs/cubic ft (64 kg/cubic m).
3. Melting Point: Minimum temperature of 2000° F (1093° C)

4. Surface Burning Characteristics per ASTM E84:
    a. Flame spread 0 and Smoke Developed 0.
5. Moisture resistance: Absorbs less than 1% by volume per ASTM C1104.
6. Spray adhesive: Hardcast Travel-Tack or Carlise Cav-Grip.

B. Sound Batt Insulation: Mineral Fiber Batt Insulation, Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665, type 1; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84. Fiberglass batts are not considered an equal.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Thickness: 2" thick batts at stud cavities (unless noted different on drawings), 3" thick elsewhere.

2.03 ACOUSTIC SPRAY SYSTEM

A. Hilti CP 572 Smoke and Acoustic Spray or equal.
1. Chemical basis: Acrylic
2. Curving time: +/- 3 days
3. Skin-forming time: +/- 15 minutes
4. Application temperature range: 40ºF to 104 ºF
5. STC classification per ASTM E90: 56
6. Flame spread per ASTEM E84-08: Flame spread: 10 and smoke development: 5
7. Movement capability: Approximately 12.5%
8. Mold resistant
9. Backing material: Mineral wool.
10. Installation thickness: minimum 1/8” (wet).

2.04 EXPANDING FOAM INSULATION

A. DuPont Great Stuff Pro or equal one part polyurethane foam sealant. For conditions where foam will be exposed inside a building (not covered with gypsum board) use DuPont Great Stuff Fireblock or equal.
1. Conform to ASTM C557-93, D6464, CA25-4 and is UL Class 1 (Flame Spread of 15, Smoke of 20). ASTM E84, E815 and UL 1715 for Fireblock products.
2. Application temperature range of 25°F to 120°F.
3. Paintable, stainable and sandable.
4. Acoustical Rating: Sound transmission class rating of 69.
5. Minimum R.Value of 4 per inch.

2.05 VAPOR BARRIERS

A. Walls/Attics: Glass reinforced or laminated polyethylene sheet, minimum perm rating, 0.1 when tested in accordance with ASTM-E96, Procedure A.
1. Vapor Barrier Tape: Compatible polyethylene self-adhesive tape recommended by vapor barrier manufacturer.
2. Adhesive: Manufacturers vapor-proofing mastic.

2.06 BUILDING WRAP

A. Tyvek Commercial “D” Wrap by DuPont de Nemours, www.dupont.com or equal.
1. High Performance Spunbonded olefin, non-woven, non-perforated with the following performance characteristics:
    a. Air Penetration: Type 1 when tested in accordance with ASTM E 1677.
    b. Water Vapor Transmission: 30 perms, when tested in accordance with ASTM E96, Method B.
    c. Water Penetration Resistance: 235 cm when tested in accordance with AATCC Test Method 127.
    d. Basis Weight: 2.4 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.
    e. Air Infiltration Resistance: Air infiltration at >750 seconds, when tested in accordance with TAPPI Test Method T-460.
    f. Breaking Strength: 33/41 lbs/in., when tested in accordance with ASTM D 822, Method A.
    g. Tear Resistant (Trapezoid) 6/9 lbs when tested in accordance with ASTM D1117.
    h. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 15, Smoke Developed: 25.
    i. UV Exposure: Up to 270 days/9 months without harming performance characteristics.
2. Seam Tape: 3” DuPont™ Tyvek® Tape.
3. Fasteners with Self-Gasketing high density polyethylene cap washers.

4. Composite, strip or fluid applied flashing and primer as recommended by manufacturer.
5. Sealants and/or closed cell polyurethane foam insulation as recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation/products.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 INSTALLATION-GENERAL

A. Install in accordance with manufacturer's instructions.

B. Install without gaps or voids. Do not compress insulation.

C. Fit insulation tight to exterior side of mechanical and electrical services within plane of insulation.

D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

E. Ensure overall installation presents flush, level surface.

3.03 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Refer to Concrete, Masonry or Waterproofing specification for installation.

B. Apply adhesive to back of boards:

1. Three continuous beads per board length.

C. Install boards horizontally on foundation perimeter.

1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Immediately following application of board insulation, place metal UV protection over exposed insulation surfaces and to 8" below grade.

3.04 BOARD INSTALLATION AT EXTERIOR WALLS

A. Refer to metal or wood stud specification for installation.

B. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches (406 mm) on center with manufacturer recommended mechanical fasteners.

C. Arrange boards with long dimension perpendicular to framing to wall studs. Stagger vertical joints between courses by one or more studs.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

E. At radiused walls, install boards in widths as required to prevent a segmented look. Kurf boards (insulation and plywood) as required for a tight fit.

F. Use maximum board lengths to minimize joints.

3.05 BOARD INSTALLATION AT CAVITY WALLS

A. Refer to Masonry or Concrete (depending on substrate) section for installation.

B. Install boards to fit snugly between wall ties.

C. Install boards horizontally on walls.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.06 BATT INSTALLATION

A. Refer to metal or wood stud specification for installation.

B. Install insulation and vapor barrier if spray foam insulation is not being used for vapor barrier in accordance with manufacturer's instructions.

C. Install in exterior cavity spaces without gaps or voids. Do not compress insulation.

D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

E. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.07 PROTECTION

A. Cover top and edges of unfinished wall panel work to protect it from weather and to prevent accumulation of water in cores of panels.

B. If panels become wet inadvertently, allow wet panels to completely dry prior to application of subsequent coverings.
C. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 21 00

SECTION 07 21 19
SPRAY FOAM INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish and install all labor, materials, tools and equipment necessary for the application of spray-polyurethane building-envelope insulation system noted as spray foam insulation.
B. Provide insulation to a thickness that equals an aged value of R-13 for exterior stud cavities and R-10 everywhere else and at least a .70 perm rating unless noted otherwise on the drawings.
C. Applied protective coating on spray foam exposed in exterior canopies or interior plenums.
D. Horizontal Batt Insulation at floor plate in stud cavity as required by NFPA 285.
E. Protective intumescent coating.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
C. Certifications: For manufacturers who are not listed in specification and published data sheets do not indicate compliance with all specification requirements, provide letter of certification that all products comply with the specification requirements; include primers (if required), foam, and coatings.
D. Applicator's Field Quality Control Procedures: Written description of procedures to be utilized to insure proper preparation and installation of foam, coatings, detail work and follow-up inspection.
E. Provide compliance documentation that the product meets the specified NFPA 285 Wall Assembly.

1.03 QUALITY ASSURANCE

A. Comply with the manufacturer's instructions and recommendations as to handling and safety procedures.
B. Provide materials packaged in the manufacturer's original, tightly sealed containers or unopened packages, clearly labeled with the manufacturer's name, product identification, safety information, and batch or lot numbers where appropriate.
C. Store materials out of the weather and out of direct sunlight in locations where the temperatures are within the limits specified by the manufacturer.
D. All materials shall be stored in compliance with the local fire and safety requirements.

1.04 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.
    1. Heating can be done to bring up surface temperatures recommended by manufacturer using indirect fire propane heaters, radiant (surface) heaters or #2 fuel oil heaters 24 to 72 continuous hours before applying foam.

1.05 WARRANTY

A. General: The Contractor shall warrant the sprayed foam vapor barrier to be free of defects in accordance with the General Conditions. This warranty shall be extended by the following manufacturer and installer warranties.
B. Material Warranty: Provide manufacturer's warranty that all components of the sprayed foam vapor barrier system are free of defects in materials.
C. Warranty Period: 3 years from Date of Substantial Completion of spray foam air barrier installation.

PART 2 PRODUCTS

2.01 NFPA 285 COMPLIANCE

A. This project is designed around a specific engineering evaluation to meet NFPA Wall Assembly tests. Refer to Section for the appropriate test under "Rigid Insulation" that this specification section must comply with.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
    1. Thermal Resistance: R-value (RSI-value) of 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.

2. Water Vapor Permeance: Vapor retarder; less than 1 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
4. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
5. Closed Cell Content: At least 90 percent.
6. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
7. Products:
   a. BASF Corporation, www.spf.basf.com: WALLTITE
   b. Carlise Spray Foam Insulation, www.carlisesfi.com: SealTite PRO
   c. Gaco/Firestone Building Products, www.gaco.com: Gaco One Pass F1850
   d. ICYNENE, www.icynene.com: Pro Seal (MD-C-200 V3)
   e. Johns Mansville, jm.com: Corbond III or VI
   f. NCFI Polyurethanes, www.ncfi.com: INSUL BLOC
   g. SWD Urethane, www.swdurethane.com: QUIK-SHIELD 112
   h. THERMOSEAL, www.thermosealusa.com: Thermoseal 2000

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.
B. Protective Coating: Intumescent coating as required to comply with applicable codes.
C. Exterior Batt Insulation for horizontal fire stopping at juncture of floor and exterior wall assemblies for NPFA 285 compliance:
   1. Unfaced lighweight, semi-rigid stone or mineral wool insulation produced by combining thermosetting resins with mineral fibers manufactured from glass, slag, wool or rock wool.
   2. Density: 4.0 lbs/cubic ft (64 kg/cubic m).
   3. Melting Point: Minimum temperature of 2000° F (1093° C).
   4. Surface Burning Characteristics per ASTM E84:
      a. Flame spread 0 and Smoke Developed 0.
   5. Moisture resistance: Absorbs less than 1% by volume per ASTM C1104.
   6. Spray adhesive: Hardcast Travel-Tack or Carlise Cav-Grip.
D. Foil Faced Flashing: Membrane consisting of 0.036 inch of self-adhesive rubberized asphalt integrally bonded to .4 mil aluminum faced high density cross laminated polyethylene film to provide a 40 mil thick membrane. Low temperature membrane if required by project schedule. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.
B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.
B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

3.04 CLEAN UP

A. Remove overspray from face of studs, finished surfaces and other surfaces that will inhibit the work of other trades.
B. Properly dispose of waste materials and containers, in compliance with the manufacturer’s guidelines and/or appropriate regulating agencies.

END OF SECTION 07 21 19

SECTION 07 21 26
BLOWN INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling and Attic: Blown insulation pneumatically placed into joist spaces through access holes.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and limitations.

C. Manufacturer's Installation Instructions: Indicate procedure for preparation and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Blown Insulation:

1. Johns Manville: www.jm.com.
2. Equivalent products by other manufacturers are acceptable.

2.02 MATERIALS

A. Applications: Provide blown insulation in attic and ceiling as indicated on drawings.

B. Blown Insulation: ASTM C764, fiberglass type, nodulated for pour and bulk for pneumatic placement.

1. Installed Thickness: As indicated on drawings.
2. Thermal Resistance (R-value (RSI-value): 11.0 sq ft hr deg F/BTU inch (1.9372 sq m K/W inch), minimum.

2.03 ACCESSORIES

A. Roof Ventilation Baffles: Prefabricated ventilation channels for placement under roof sheathing with baffles to prevent wind-washing.

1. Material: Polyvinyl chloride (PVC).
2. Match Roof Joist/Truss Spacing.
3. Manufacturers:
   a. Brentwood Industries, Inc; AccuVent Original: www.brentwoodindustries.com or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and adjacent materials are dry and ready to receive insulation.

B. Verify that light fixtures have thermal cut-out device to restrict over-heating in soffit or ceiling spaces.

C. Verify spaces are unobstructed to allow for proper placement of insulation.

3.02 INSTALLATION

A. Install insulation and ventilation baffle in accordance with ASTM C1015 and manufacturer's instructions.

B. Completely fill intended spaces leaving no gaps or voids.

3.03 CLEANING

A. Remove loose insulation residue.

END OF SECTION 07 21 26

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid applied high-build vapor impermeable weather barrier on back-up masonry and concrete. Provide all auxiliary materials including liquid membrane for detailing wall primer, flexible membrane, joint reinforcing strips, transition membranes, substrate patching membrane, and foam sealant for a complete installation.

B. Fluid applied high-build vapor permeable weather barrier on exterior sheathing/stud wall construction. Provide all auxiliary materials including liquid membrane for detailing wall primer, flexible membrane, joint reinforcing strips, transition membranes, substrate patching membrane, and foam sealant for a complete installation.

1.02 DEFINITIONS

A. Weather Barriers: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicating the perm rating and the manufacturers application thickness meets the specified Dry Film Thickness (DFT) of the weather barrier. Note: Applying multiple coats of a thinner product to meet the specified DFT is not acceptable.

C. Shop Drawings: Provide drawings showing locations and extent of each type of weather barrier. Include details for substrate joints and cracks, counter flashing strips, penetrations, inside and outside corners, terminations, tie-ins with adjoining construction and details of interfaces with other materials that form part of the weather barrier system.

D. Product Certificates: Certifying compatibility of weather barrier and accessory materials with project materials that connect to or that come in contact with the barrier including through wall flashings, signed by the product manufacturer.

E. Qualification Data: For applicator from weather barrier manufacturer.

F. Provide compliance documentation that the product meets the specified NFPA 285 Wall Assembly.

1.04 QUALITY ASSURANCE

A. General: Weather barrier shall be capable of performing as a continuous vapor-impermeable or vapor permeable weather barrier and as a water resistive drainage plane flashed to discharge to the exterior incidental condensation or water penetration. The vapor-impermeable weather barrier will also serve as a vapor barrier. The weather barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage meeting specified limits.

B. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit. Installer shall be approved in writing by the product manufacturer.

C. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

D. Source Limitations: Obtain primary weather-barrier material and through wall flashing through one source from a single manufacturer or have approval from each product manufacturer to ensure compatibility to each other.

E. Pre-installation Conference: Shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Conference shall include the Contractor, installer, Architect, Owner's Testing Agency, and system manufacturer's field representative and all other trades attaching flashings and sealants to the weather barrier (including but not limited to installers of masonry, windows/curtainwalls/storefront, louvers, roofing and exterior wall cladding). Agenda for the meeting shall include the but not limited to :

1. Review of submittals.
2. Review of surface preparation, minimum curing period and installation procedures.
3. Review of special details and flashings being installed by all trades.
4. Sequence of construction, responsibilities and schedule for subsequent operations.
5. Review of mock-up requirements.

6. Review of inspection, testing, protection and repair procedures.

1.05 MOCK-UPS

A. Before beginning instillation of weather barriers, provide a mock-up for each different type of weather barrier and back-up substrate.

B. Coordinate construction of mockup to permit inspection by Owner's testing agency of weather barrier before it is covered by insulation or cladding.

C. If Architect or Owner's Testing Agency determines mockups do not comply with requirements, reconstruct mockups and apply weather barrier until mockups are approved at no additional cost to the Owner.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 NFPA 285 COMPLIANCE

A. This project is designed around an a specific engineering evaluation to meet NFPA Wall Assembly tests. Refer to Section 07 21 00 Insulation for the appropriate test under “Rigid Insulation” that this specification section must comply with.

2.02 WEATHER BARRIER MATERIALS (VAPOR PERMEABLE)

A. Fluid Applied: Vapor permeable, elastomeric coating.

1. Material requirements:
   a. Dry Film Thickness (DFT): 25 mils, 0.025 inch (0.635 mm) minimum (no exceptions). Applying multiple coats of a thinner product is not acceptable.
   b. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to four months of weather exposure after application.
   c. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   d. Complies with NFPA 285 wall assembly requirements.
   e. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
   f. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
   g. Manufacturers/products:
      1) Carlisle Coatings and Waterproofing, Inc; Fire Resist Barrithane VP: www.carlisleccw.com.
      2) GCP Applied Technologies; Perm-A-Barrier VPL: www.gcpat.com.
      3) Henry Company; Air-Bloc 17MR: www.henry.com.
      4) Hohmann & Barnard, Inc; ENVIRO-BARRIER VP: www.h-b.com.
      5) W.R. Meadows, Inc; Air-Shield LMP: www.wrmeadows.com.

2.03 WEATHER BARRIER MATERIALS (VAPOR IMPERMEABLE)

A. Vapor Retarder Coating: Liquid applied, resilient, UV-resistant coating and associated joint treatment with the following material requirements:

1. Dry Film Thickness (DFT): 30 mils, 0.030 inch (0.762 mm), minimum (no exceptions). Applying multiple coats of a thinner product is not acceptable.
2. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M.
3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
4. Complies with NFPA 285 wall assembly requirements.

B. Manufacturers/products:

1. Carlisle Coatings and Waterproofing, Inc; Fire Resist Barritech NP: www.carlisleccw.com.
2. Henry Company; Air-Bloc 16MR: www.henry.com.
3. GCP Applied Technologies; Perm-A-Barrier NPL 10: www.gcpat.com.
4. NaturaSeal; Air Seal NS-A250-LP: www.naturaseal.com.
5. Hohmann & Barnard, Inc; ENVIRO-BARRIER: www.h-b.com.
6. Tremco Commercial Sealants & Waterproofing; ExoAir 130: www.tremcosealants.com.
7. W.R. Meadows, Inc; Air-Shield LSR: www.wrmeadows.com.

2.04 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.
B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and barrier materials.
   1. Application: As recommended by manufacturer.
C. Primer: If recommended by the manufacturer.
D. Flexible Flashing: Self-adhesive sheet flashing comply with manufacturers recommendations.
E. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing as recommended by the manufacturer.
F. Thinners and Cleaners: As recommended by water-resistive barrier manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section and accept the substrate. If the substrate is not acceptable, notify the General Contractor or Construction Manager for coordination of correction.

3.02 PREPARATION

A. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.
B. Weather Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
D. Coatings:
   1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
   2. Where exterior masonry veneer is to be installed, have masonry anchors installed before installing weather barrier over masonry; seal around anchors air tight.
   3. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.
E. Openings and Penetrations in Exterior Water-Resistive Barriers:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches (127 mm) onto water-resistive barrier and at least 6 inches (152 mm) up jambs; mechanically fasten stretched edges.
   2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
   3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
   4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches (50 mm) beyond face of jambs; seal water-resistive barrier to flashing.
   5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 FIELD QUALITY CONTROL

A. Owner’s Inspection and Testing: Cooperate with Owner’s testing agency.
   1. Allow access to work areas and staging.
   2. Notify Owner’s testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
   3. Do not cover work of this section until testing and inspection is accepted.
B. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Inspections: Weather barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following (note that inspections of the weather barrier will not be required on poured in place concrete walls, as the Building Code does not require an air barrier on concrete walls):
   1. Continuity of weather barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of weather barrier system has been provided.
   3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
   4. Site conditions for application temperature and dryness of substrates have been maintained.
   5. Maximum exposure time of materials to UV deterioration has not been exceeded.
   6. Surfaces have been primed, if applicable.
   7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   8. Termination mastic has been applied on cut edges.
   9. Strips and transition strips have been firmly adhered to substrate.
   10. Compatible materials have been used.
   11. Transitions at changes in direction and structural support at gaps have been provided.
   12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
   13. All penetrations have been sealed.

D. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
   1. Qualitative Testing: Weather barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, smoke pencil with pressurization or depressurization.

E. Remove and replace deficient weather barrier components and retest as specified above. Costs for re-testing will be the responsibility of the installer.

END OF SECTION 07 25 00

SECTION 07 31 29

WOOD SHINGLES AND SHAKES (NON-WOLD MASTER - FOR REFERENCE ONLY)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood shakes.
B. Wood shingles.
C. Flexible sheet membranes for eave protection, underlayment, and valley protection.
D. Associated metal flashings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry-Wood Framed Buildings: Roof sheathing.
B. Section 07 62 00 - Sheet Metal Coping and Flashing : Edge and cap flashings.
C. Section 07 72 00 - Roof Accessories: Snow guards.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
C. Shop Drawings: For metal flashings, indicate specially configured metal flashings, jointing methods and locations, fastening methods and locations, and installation details.
D. Manufacturer's Instructions: Indicate installation criteria and procedures.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
F. Manufacturer's qualification statement.
G. Installer's qualification statement.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 60 00 - Product Requirements (Non-Wold Master - For Reference Only) for additional provisions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.
B. Installer Qualifications: Company specializing in installing asphalt shingles, with at least 3 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.
B. When storing roofing materials on roofing system ensure that no damage occurs to supporting members and other materials.

1.06 FIELD CONDITIONS

A. Do not install shingles and shakes, bituminous material, eave protection membrane, or _____ when surface temperatures are below 45 degrees F (7 degrees C).

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Shingles and Shakes:
    1. Westlake DaVinci Roofscapes LLC; _____: www.davinciroofscapes.com/#sle.
    2. Miller Shingle Company; _____: www.millershingle.com/#sle.
    3. Any producer and member of Cedar Shake and Shingle Bureau (CSSB); www.cedarbureau.org/#sle.

2.02 SHINGLES AND SHAKES

A. Roof and Wall Shakes: Western red cedar (Thuja plicata), handsplit and sawn, CSSB (WEB), No.1 Grade, 18 inches (457 mm) long, standard straight butt.
    1. Thickness at Butt: 1/2 inch (13 mm), nominal.
    2. Wind Resistance: Pass UL 1897.
    3. Provide CSSB labels in packaging.

2.03 SHEET MATERIALS

A. Roof Sheathing: See Section 06 10 00.

B. Mineral Surfaced Roll Roofing: Asphalt-coated organic felt, mineral granule surfaced, complying with ASTM D6380/D6380M, Class M, Type II, with 2-inch wide selvage (51 mm wide selvage); color as selected.

C. Mineral Surfaced Roll Roofing: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3909/D3909M, minimum weight of granule surfaced portion of 63 lb/100 sq ft (28.6 kg/9.3 sq m); color as selected.

D. Smooth Surfaced Roll Roofing: Asphalt-coated organic felt, with smooth asphalt coating both sides, complying with ASTM D6380/D6380M, Class S, Type IV, 39.8 lb/100 sq ft (Type IV, 1.94 kg/sq m).

E. Ventilation Mat: Polymeric or nylon roof ventilation mat for wood roof sheathing applications.

1. Thickness: 3/8 inch (9.5 mm), nominal.
2. Width: 39 inches (990 mm).
3. Weight per Unit Area: 8.66 oz/sq yd (0.2 kg/sq m) in accordance with ASTM D5261.
4. Products:
   a. Advanced Building Products, Inc; CedAir-Mat Roof Ventilation Mat: www.advancedbuildingproducts.com/#sle.
   b. Keene Building Products; Viper CDR Vent: www.keenebuilding.com/#sle.

F. Eave Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil, 0.040 inch (1 mm) total thickness; with strippable treated release paper and polyethylene sheet top surface.

G. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.

1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
2. Ultraviolet Resistance and Weatherability: Approved in writing by manufacturer for exposure to weather for minimum of 6 months.
3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
4. Fasteners: As required by manufacturer and in compliance with local building code requirements.

2.04 METAL FLASHINGS

A. Metal Flashings: Galvanized steel, see Section 07 62 00.

B. Metal Flashings: Provide sheet metal eave edge, gable edge, ridge, ridge vents, open valley flashing, chimney flashing, dormer flashing, and other flashing indicated.

1. Form flashings to profiles indicated on Drawings.
2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
3. Hem exposed edges of flashings minimum 1/4 inch (6 mm) on underside.

2.05 ACCESSORIES

A. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, of sufficient length to penetrate through roof sheathing or 3/4 inch (19 mm) into roof sheathing or decking.

B. Bituminous Paint: Acid and alkali resistant type; black color.

C. Asphalt Roof Cement: ASTM D4586/D4586M, Type I or II, asbestos-free.

D. Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.

E. Preservative Treatment: Dip type, water-based, clear, water repellant, fungus resistant, decay resistant.

F. Ridge Vents: Plastic, extruded with vent openings that do not permit direct water or weather entry; flanged to receive shingles.

G. Snow Guards: See Section 07 72 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

C. Verify roof openings are correctly framed.

D. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

B. Broom clean deck surfaces before installing underlayment or eave protection.

C. Install eave edge flashings tight with fascia boards, weather lap joints 2 inches (51 mm) and seal with plastic cement, and secure flange with nails spaced ____ inches (____ mm) on center.

3.03 INSTALLATION

A. Install in accordance with this specification and the following, whichever is more stringent:
   1. Applicable building code(s).
   2. Manufacturer's installation instructions.

B. Eave Protection Membrane:
   1. Install eave protection membrane from eave edge to minimum 4 feet (1219 mm) up-slope beyond interior face of exterior wall.

C. Underlayment:
   1. Roof Slopes Less Than 4:12: Install two layers of underlayment over entire roof area, with ends and edges weather lapped minimum 4 inches (100 mm); stagger end laps of each consecutive layer, and nail in place.
   2. Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches (100 mm); stagger end laps of each consecutive layer, nail in place, and weather lap over eave protection minimum 4 inches (100 mm).
   3. Items projecting through or mounted on roof, weather lap and seal watertight with plastic cement.

D. Valley Protection:
   1. Install one ply of smooth surfaced roll roofing, minimum 18 inches (450 mm) wide, centered over valleys.
   2. Weather lap joints minimum 2 inches (50 mm).
   3. Nail in place minimum 18 inches (450 mm) on center, 1 inch (25 mm) from edges.

E. Metal Flashings:
   1. Install flashings in accordance with CSSB (RMAN) - New Roof Construction Manual.
   2. Weather lap joints minimum 2 inches (50 mm) and seal weathertight with plastic cement.
   3. Secure in place with nails at ____ inches (____ mm) on center, and conceal fastenings.

F. Shingles and Shakes:
   1. Install using not less than two fasteners for each shingle or shake.

3.04 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

3.05 PROTECTION

A. Do not permit traffic over finished roof surface.

END OF SECTION 07 31 29

SECTION 07 46 46
FIBER-CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiber-cement siding including all trim, fascia, moulding and accessories.
B. Fiber-cement panel system including all trim, fascia, moulding and accessories.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturer's data sheets on each product to be used.
C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
D. Warranty: Submit sample warranty for the specified duration.

1.03 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Sustainable Waste Management and Disposal for packaging waste requirements.
B. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
C. Store products under waterproof cover and elevated above grade, on a flat surface.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Product warranty: Limited, non-prorated product warranty.
   1. Duration: 15 years.
   2. Duration: 30 years.
C. Finish warranty: Limited product warranty against peeling, cracking and chipping.
   1. Duration: 15 years.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Standard lap style.
   2. Texture: Smooth.
   3. Length: 12 feet (3.7 m), nominal.
   4. Width (Height): 5-1/4 inches (133 mm).
   5. Thickness: 5/16 inch (8 mm), nominal.
   6. Finish: Factory applied primer.
   7. Finish: Factory applied topcoat.
      a. Color: _____.
   8. Products:
      a. James Hardie Building Products, Inc; Hardie Plank Lap Siding: www.jameshardie.com.
      b. Equivalent products by other manufacturers are acceptable.
B. Panels: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Texture: Smooth.
   2. Length (Height): 96 inches (2400 mm), nominal.
   3. Width: 48 inches (1220 mm).
   4. Thickness: 5/16 inch (8 mm), nominal.
   5. Finish: Factory applied primer.
   6. Finish: Factory applied topcoat.
      a. Color: _____.
   7. Products:
      a. James Hardie Building Products, Inc; Hardie Reveal Panel: www.jameshardie.com.
      b. Equivalent products by other manufacturers are acceptable.

C. Shingle Panels: Panels giving appearance of multiple shingles made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Random width, straight edge.
   2. Texture: Smooth.
   3. Length: 48 inches (1220 mm).
   4. Width (Height): 7 inches (178 mm).
   5. Thickness: 1/4 inch (6 mm), nominal.
   6. Finish: Factory applied primer.
   7. Finish: Factory applied topcoat.
   8. Color: _____.
   9. Products:
      a. James Hardie Building Products, Inc; Hardie Reveal Panel: www.jameshardie.com.
      b. Equivalent products by other manufacturers are acceptable.

D. Shingles: Individual simulated wood shingles made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Straight edged.
   2. Texture: Simulated cedar grain.
   3. Length (Height): 18 inches (455 mm), nominal.
   4. Thickness: 1/4 inch (6.4 mm), nominal.
   5. Finish: Factory applied primer.
   6. Finish: Factory applied topcoat.
   7. Color: _____.
   8. Products:
      a. James Hardie Building Products, Inc; HardieShingle: www.jameshardie.com.
      b. Equivalent products by other manufacturers are acceptable.

E. Soffit Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Texture: Smooth.
   2. Length: 96 inches (2440 mm), nominal.
   3. Width: 48 inches (1220 mm).
   4. Thickness: 5/16 inch (7.9 mm), nominal.
   5. Finish: Unfinished.
   6. Manufacturer: Same as siding.

2.02 ACCESSORIES

A. Cladding Support Clips: Thermally-broken, galvanized steel clips for support of cladding z-girts, angles, channels and other framing.
   1. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 galvanized coating.

B. Furring Strips, Metal: Galvanized metal channels.

C. Fasteners
   1. Wood Framing Fasteners:
      a. Corrosion resistant ring shank nails. Shank, length and head size as recommended by siding manufacturer.
      b. Wood Framing into WSP: Head corrosion resistant ribbed wafer head screws, size as recommended by siding manufacturer.
   2. Metal Framing:
   3. Head self-drilling, corrosion resistant S-12 ribbed buglehead screws, size as recommended by siding manufacturer.
      a. Metal Framing: ET&F Pin or equivalent pneumatic fastener, size as recommended by siding manufacturer.
   4. Masonry Walls (CMU):

a. ET&F No. ASM-144-XXX. Corrosion resistant nails, size as recommended by siding manufacturer.
b. Max System CP-C XXX W7-ICC. Corrosion resistant nails, size as recommended by siding manufacturer.
c. Aerosmith SurePin 0.144 inch shank by 0.30 inch head long corrosion resistant nails. Length as recommended by siding manufacturer.
d. Jaaco Nail Pro NP145S, size as recommended by siding manufacturer.

D. Trim: Same material and texture as siding.
1. Sizes as detailed on the drawings.

E. Trim for Panel System:
1. Trims: Reveal™ Trims manufactured by Custom Aluminum of Elgin, IL in the following profiles supplied by James Hardie. Aluminum alloy 6063-T5 with a minimum thickness of 0.050 inch. All reveal trims are 8 feet in length.

F. Exterior Soffit Vents: One piece, perforated, ASTM B221 (ASTM B221M), 6063 alloy, T5 temper, aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application, and provide continuous vent.

G. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Verify that weather barrier has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Protect surrounding areas and adjacent surfaces during execution of this work.

B. Install Sheet Metal Flashing:
1. Above door and window trim and casings.
2. Above horizontal trim in field of siding.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
1. Read warranty and comply with terms necessary to maintain warranty coverage.
2. Use trim details as indicated on drawings.
3. Touch up field cut edges before installing.
4. Pre-drill nail holes if necessary to prevent breakage.

B. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.

C. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.

D. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

E. Do not install siding less than 6 inches (152 mm) from ground surface, or closer than 1 inch (25.4 mm) to roofs, patios, porches, and other surfaces where water may collect.

F. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

3.04 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 07 46 46

SECTION 07 62 00
SHEET METAL COPING AND FLASHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet metal coping (pre-fabricated coping or ANSI-SPRI ES-1 approved contractor fabricated coping) , flashing and counterflashing as shown on drawings.
B. Sheet metal gutters and downspouts.
C. Sheet metal scuppers and downspouts.
D. Flexible flashing/underlayment under all metal.
E. Sheet metal vented soffit systems.
F. Sealants for joints within sheet metal fabrications.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details. Indicate locations of pre-finished metal (if there is only one color for the entire project, this item is not required).
    1. If there are no items submitted, it will be assumed that all the details on the drawings are acceptable for all conditions on site to install a leak free system. RFI's will be rejected once construction starts.
C. Samples: Submit 2 samples in size illustrating metal finish color.
D. For Contractor fabricated ANSI/SPRI ES-1 coping and /or fascia submit documentation that contractor has a NRCA authorized fabricator agreement for NRCA's UL Certification for ANSI/SPRI ES-1.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Flashing and Trim:
    1. Products by Elevate: www.holcimelevate.com are specified.
    2. Equivalent products by other manufacturers with matching colors are acceptable.

2.02 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 22 gauge, 1/32 inch (0.7 mm) thick base metal.
B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
    1. Color #1: _____.
    2. Color #2: _____.
C. Aluminum: ASTM B209 (ASTM B209M); 20 gauge, 0.032 inch (0.81 mm) thick; anodized finish of color as selected.
    1. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils (0.018 mm) thick.
    2. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils (0.018 mm) thick.
        a. Color #1: _____.
        b. Color #2: _____.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Form pieces in longest possible lengths.
C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.
F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 ANSI/SPRI ES-1 FABRICATION

A. Pre-fabricated Copings:
   1. If contractor can demonstrate that fabricated copings/fascias meet the requirements of ANSI/SPRI ES-1, pre-fabricated copings are not required]
   2. Coping: Firestone Building Products – UNA-Edge Coping System. Other manufacturers meeting specified requirements are acceptable, subject to approval of color and warranty.
   3. Meet ANSI / SPRI ES-1 wind design standards for conformance to requirements of International Building Code. Note: For Contractor fabricated coping, provide documentation that contractor has a NRCA authorized fabricator agreement for NRCA's UL Certification for ANSI/SPRI ES-1.
   4. Materials
   5. Coping cover shall be 24 gauge galvanized with Kynar 500 finish.
   6. Accessories to include stainless steel anchor chips, concealed splice plates, coping cleats, and corrosion resistant fasteners / neoprene washers. Factory fabricated corners, end caps, frees, scuppers and sups with "quick lock" or welded seams.
   7. Provide factory fabricated special sizes, shapes, as required / detailed.

B. Pre-Fabricated Fascia:
   1. If contractor can demonstrate that fabricated openings/fascias meet the requirements of ANSI/SPRI ES-1, pre-fabricated copings are not required.
   2. Fascia: Firestone Building Products: UNA-Edge gravel stop system. Other manufacturers meeting specified requirements are acceptable, subject to approval of color and warranty.
      a. Meet ANSI/SPRI ES-1 wind design standards for conformance to requirements of International Building Code. Note: For Contractor fabricated coping, provide documentation that contractor has a NRCA authorized fabricator agreement for NRCA's UL Certification for ANSI/SPRI ES-1.
      b. Fascia cover shall be 24 gauge galvanized with Kynar 500 finish.
      c. Accessories to include extruded aluminum anchor bar, anchor bar splice plates, closed cell compression gaskets, and corrosion resistant fasteners.
      d. Sizes as detailed.

2.05 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.
B. Downspouts: Rectangular profile.
C. Gutters and Downspouts: Size indicated.
D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
E. Seal metal joints.

2.06 SCUPPER AND DOWNSPOUT FABRICATION

A. Fabricate scuppers and/or overflow scuppers as detailed.
B. Downspouts: 3 sided rectangular profile, size indicated.
C. Accessories: Profiled to suit downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.

2.07 SOFFIT PANELS

A. Vented Soffit Panels: Elevate Una-Clad UC-500.
   1. 22 gauge, Kynar coated galvanized steel.
   2. Depth: 1 inch (25.4 mm).
   3. Width:
      a. 8 inch (203.2 mm).
      b. 12 inch (304.8 mm).
      c. 16 inch (406.4 mm).
      d. 18 inch (457.2 mm).

e. 20 inch (508 mm).

4. Color(s): _____.

2.08 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Flexible Flashings/Underlayment under metal: Grace Ice and Water Shield; www.gcpat.com or equal.

1. 40 mil rubberized asphalt adhesive backed by high density cross laminated polyethylene.
2. Tensile Strength: 250 psi per ASTM D412 (Die C Modified).
3. Elongation: 250% per ASTM D412 (Die C Modified).

C. Primer Type: Zinc chromate.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Concealed Sealants: Non-curing butyl sealant.

F. Exposed Sealants: ASTM C920; elastomeric silicone polymer sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

G. Plastic Cement: ASTM D4586/D4586M, Type I.

H. Solder: ASTM B32; Sn50 (50/50) type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Secure gutters and downspouts in place with concealed fasteners.

E. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.

END OF SECTION 07 62 00

SECTION 07 84 00
FIRESTOPPING

NOTE: KEEP THE HIGHEST RATING YOU HAVE AND TURN OFF THE REST
TURN OFF FOR ONE HOUR AND LESS
TURN OFF TWO HOUR AND LESS
TURN OFF THREE HOUR AND LESS
TURN OFF FOUR HOUR AND LESS
TURN OFF LABELING OF PENETRATIONS (HEALTHCARE USES)
TURN OFF SUSTAINABLILITY
TURN OFF BATHTUBS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.
   1. One hour and less.
   2. Two hour and less.
   3. Three hour and less.
   4. Four hour and less.

B. Acoustic and Smoke Spray is specified in Section 07 21 00 Insulation and installed by Sections 04 20 00 Non-bearing Unit Masonry and 09 21 16 Gypsum Wallboard Assemblies.

C. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

D. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

E. Safing slot gaps between edge of floor slabs and curtain walls.

F. Openings between structurally separate sections of wall or floors.

G. Gaps between the top of walls and ceilings or roof assemblies.

H. Expansion joints in walls and floors.

I. Openings and penetrations in fire-rated partitions or walls containing fire doors.

J. Openings around structural members which penetrate floors or walls.

K. Labeling of fire stopped penetrations.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

1.03 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

1.04 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. Hilti, Inc: www.us.hilti.com.
   2. HoldRite, a Brand of Reliance Worldwide Corporation: www.holdrite.com.
   3. Specified Technologies Inc: www.stifirestop.com.
   4. Other manufacturers with similar products are acceptable.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
D. Fire Ratings: Refer to Code Drawings for required ratings.
E. Identification Labels
    1. Pressure-sensitive, self adhesive, preprinted vinyl labels with the following verbiage:
    2. "Warning: Fireblocking Application – Do Not Disturb. Notify Building Management of Any Damage"
    3. Installing Contractor's name, address and phone number.
    4. Date of installation.
    5. Fireblocking/Stopping product manufacturer's name.
F. Firesafing material: Formaldehyde free semi-rigid mineral wool.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
    1. Movement: Provide systems that have been tested to show movement capability as indicated.
C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
    1. Movement: Provide systems that have been tested to show movement capability as indicated.
    2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
    3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
    4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
    1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
    2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
    3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
    4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING FOR (1) ONE HOUR AND LOWER RATED ASSEMBLIES

A. FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS
    1. Gypsum Board Walls:
        a. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
            1) 1 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
        b. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
            1) 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
        c. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
            1) 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
        d. Head-of-Wall Joints at Underside of Flat Concrete:
            1) 1 Hour Construction: UL System HW-D-0079; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
            2) 1 Hour Construction: UL System HW-D-0371; Specified Technologies Inc. SpeedFlex Joint Profile System.

3) 1 Hour Construction: UL System HW-D-0689; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
4) 1 Hour Construction: UL System HW-D-0696; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
5) 1 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
6) 1 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.

e. Head-of-Wall Joints at Concrete Over Metal Deck:
1) 1 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
2) 1 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
3) 1 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.
4) 2 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
5) 1 Hour Construction: UL System HW-D-0365; Specified Technologies Inc. SpeedFlex Joint Profile System.
6) 1 Hour Construction: UL System HW-D-0548; Specified Technologies Inc. SpeedFlex Joint Profile System.
7) 1 Hour Construction: UL System HW-D-0749; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

f. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
1) 1 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2) 1 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.

g. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
1) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

h. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
1) 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

B. FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

1. Penetrations Through Floors or Walls By:
a. Bathtub Drains:
1) Up to 3 Hour Construction: UL System F-A-1037, F-A-1038, F-A-2094, or F-A-2095; Hilti CP 681 Tub Box Kit.
2) Up to 3 Hour Construction: UL System F-A-2183; HoldRite HydroFlame HFPTB-NP-0200, HFPTB-TW-0200, TB-NP-0200, or TB-TW-0200.

b. Uninsulated Metallic Pipe, Conduit, and Tubing:
1) Up to 4 Hour Construction: UL System C-AJ-1739; HoldRite HydroFlame 300 CG (Caulk Grade - Walls or Floors) Silicone Firestop Sealant.

2. Penetrations Through Floors By:
a. Electrical Cables Not In Conduit:
1) 2 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
2) 2 Hour Construction: UL System F-A-3032; Specified Technologies Inc. Ready Split Sleeve.

b. Low Voltage Cables Not In Conduit:
1) 2 Hour Construction: UL System F-A-3058; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.

c. Electrical Busways:
1) 2 Hour Construction: UL System F-A-6002; Hilti CP 604 Self-Leveling Firestop Sealant.

d. Insulated Pipes:
    1) 2 and 3 Hour Construction: UL System F-A-5043; HoldRite HydroFlame HFP-Px, or HFP-PxB Cast-In Device.
    2) 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.
    3) 2 Hour Construction: UL System F-A-5017; Hilti CP 680-P/M Cast-In Device.
    4) 2 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID Cast-In Device.
    5) 2 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID Cast-In Device.

3. Penetrations Through Walls By:
    a. Uninsulated Metallic Pipe, Conduit, and Tubing:
        1) 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    b. Insulated Pipes:
        1) 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
        2) 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

C. FIRESTOPPING PENETRATIONS THROUGH FRAMED FLOORS
1. Metallic Pipe, Conduit, and Tubing Penetrations in Framed Floors:
    a. 1 and 2 Hour Construction: UL System F-C-1177; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
    b. 1 Hour Construction: UL System F-C-1053; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
    c. 1 Hour Construction: UL System F-C-1162; Specified Technologies Inc. Closet Flange Firestop Gasket.
2. Non-Metallic Pipe, Conduit or Tubing in Framed Floors:
    a. 1 and 2 Hour Construction: UL System F-C-2473; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
    b. 1 Hour Construction: UL System F-C-2487; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
    c. 1 Hour Construction: UL System F-C-2014; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
    d. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
    e. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC Collars.
    f. 1 Hour Construction: UL System F-C-2348; Specified Technologies Inc. RTC Range-Taking Collar.
    g. 1 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.
3. Electrical Cable in Framed Floors:
    a. 1 Hour Construction: UL System F-C-3010; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
    b. 1 and 2 Hour Construction: UL System F-C-3121; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4. Insulated Pipe in Framed Floors:
    a. 1 Hour Construction: UL System F-C-5043; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
5. FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS
    a. Blank Openings:
        1) 1 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
        2) 1 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.

3) 1 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
4) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

b. Penetrations By:
1) Multiple Penetrations in Large Openings:
(a) 1 and 2 Hour Construction: UL System W-L-1568; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
(b) 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(c) 1 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
(d) 1 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(e) 1 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop pillows.
(f) 1 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(g) 1 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
(h) 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(i) 2 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
2) Uninsulated Metallic Pipe, Conduit, and Tubing:
(a) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
(b) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(c) 1 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(d) 1 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(e) 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(f) 1 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(g) 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(h) 1 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(i) 1 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
(j) 1 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
3) Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
(a) 1 and 2 Hour Construction: UL System W-L-2710; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(b) 1 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
(c) 1 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.
(d) 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
(e) 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.

(f) 1 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
(g) 1 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(h) 1 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
(i) 1 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC Range-Taking Collar.

4) Electrical Cables Not In Conduit:
(a) 1 and 2 Hour Construction: UL System W-L-3453; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(b) 1 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
(c) 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
(d) 1 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(e) 1 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(f) 1 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
(g) 1 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(h) 1 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
(i) 1 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(j) 1 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.
(k) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
(l) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
(m) 1 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
(n) 1 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.
(o) 1 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.

5) Low Voltage Cable Not In Conduit:
(a) 1 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(b) 1 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(c) 1 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(d) 1 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(e) 1 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(f) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
(g) 1 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.

(h) 1 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
(i) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(j) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(k) 1 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.
(l) 1 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
(m) 1 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(n) 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

6) ***SPECIFIER NOTE: Keep below for cable trays.***
7) Cable Trays with Electrical Cables:
(a) 1 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(b) 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
(c) 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
8) Insulated Pipes:
(a) 1 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(b) 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(c) 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
(d) 1 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(e) 1 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(f) 1 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(g) 1 and 2 Hour Construction: UL System W-L-5357; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
9) HVAC Ducts, Insulated:
(a) 1 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(b) 1 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(c) 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.05 ***SPECIFIER NOTE: KEEP BELOW FOR 2 HOUR AND LOWER RATED ASSEMBLIES.***

2.06 FIRESTOPPING FOR (2) TWO HOUR AND LOWER RATED ASSEMBLIES

A. FIRESTOPPING FOR PERIMETER CONTAINMENT
1. Perimeter Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
a. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. AS200 Elastomeric Spray.
b. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. Fast Tack Firestop Spray.
c. 2 Hour Construction: UL System CW-S-0003; Specified Technologies Inc. Fast Tack Firestop Spray.

d. 2 Hour Construction: UL System CW-S-0007; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

2. Perimeter Joint Systems That Have Movement Capabilities (Dynamic-D):
   a. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. AS200 Elastomeric Spray.
   b. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. Fast Tack Firestop Spray.
   c. 2 Hour Construction: UL System CW-D-1011; Specified Technologies Inc. Fast Tack Firestop Spray.
   d. 2 Hour Construction: UL System CW-D-2042; Specified Technologies Inc. Fast Tack Firestop Spray.

B. FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS
   1. Concrete and Concrete Masonry Walls and Floors:
      a. Floor-to-Floor Joints:
         1) 2 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      b. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
         1) 2 Hour Construction: UL System HW-D-0039; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
         2) 2 Hour Construction: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
         3) 2 Hour Construction: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      c. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor:
         1) 2 Hour Construction: UL System HW-D-0268; Hilti CP 606 Flexible Firestop Sealant.
         2) 2 Hour Construction: UL System HW-D-0312; Specified Technologies Inc. SIL Silicone Sealant.
      d. Concrete/Concrete Masonry Wall-to-Wall Joint Systems That Have Movement Capabilities (Dynamic-D):
         1) 2 Hour Construction: UL System WW-D-0017; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
         2) 2 Hour Construction: UL System WW-D-0032; Hilti CP 606 Flexible Firestop Sealant.
   2. Gypsum Board Walls:
      a. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
         1) 2 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
      b. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
         1) 2 Hour Construction: UL System WW-D-0180; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
         2) 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
         3) 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
      c. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
         1) 2 Hour Construction: UL System HW-D-0252; Specified Technologies Inc. AS200 Elastomeric Spray.
         2) 2 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      d. Head-of-Wall Joints at Underside of Flat Concrete:
         1) 2 Hour Construction: UL System HW-D-0044; Specified Technologies Inc. AS200 Elastomeric Spray.
         2) 2 Hour Construction: UL System HW-D-0079; Specified Technologies Inc. ES Elastomeric Firestop Sealant.

3) 2 Hour Construction: UL System HW-D-0371; Specified Technologies Inc. SpeedFlex Joint Profile System.
4) 2 Hour Construction: UL System HW-D-0689; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
5) 2 Hour Construction: UL System HW-D-0696; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
6) 2 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
7) 2 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.
8) 1 Hour Construction: UL System HW-D-0079; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
9) 1 Hour Construction: UL System HW-D-0371; Specified Technologies Inc. SpeedFlex Joint Profile System.
10) 1 Hour Construction: UL System HW-D-0689; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
11) 1 Hour Construction: UL System HW-D-0696; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
12) 1 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
13) 1 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.

e. Head-of-Wall Joints at Concrete Over Metal Deck:
1) 2 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
2) 2 Hour Construction: UL System HW-D-0043; Specified Technologies Inc. AS200 Elastomeric Spray.
3) 2 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
4) 2 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.
5) 2 Hour Construction: UL System HW-D-0365; Specified Technologies Inc. SpeedFlex Joint Profile System.
6) 2 Hour Construction: UL System HW-D-0548; Specified Technologies Inc. SpeedFlex Joint Profile System.
7) 2 Hour Construction: UL System HW-D-0749; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
8) 1 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
9) 1 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
10) 1 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.
11) 1 Hour Construction: UL System HW-D-0365; Specified Technologies Inc. SpeedFlex Joint Profile System.
12) 1 Hour Construction: UL System HW-D-0548; Specified Technologies Inc. SpeedFlex Joint Profile System.
13) 1 Hour Construction: UL System HW-D-0749; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

f. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
1) 2 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2) 2 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

4) 1 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.

g. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
1) 2 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
2) 2 Hour Construction: UL System HW-D-0103; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

h. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
1) 2 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2) 2 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
4) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

C. FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

1. Blank Openings:
a. In Floors or Walls:
1) 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System C-AJ-0015; Specified Technologies Inc. SSM Mortar.
3) 2 Hour Construction: UL System C-AJ-0116; Specified Technologies Inc. Composite Sheet.
4) 2 Hour Construction: UL System C-AJ-0136; Specified Technologies Inc. SSM Mortar.
5) 2 Hour Construction: UL System C-AJ-0171; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
6) 2 Hour Construction: UL System C-AJ-0175; HoldRite HydroFlame 300 SL (Self-Leveling) Silicone Firestop Sealant.

2. Penetrations Through Floors or Walls By:
a. Multiple Penetrations in Large Openings:
1) 2 Hour Construction: UL System C-AJ-2863; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-8035; Specified Technologies Inc. SSM Mortar.
4) 2 Hour Construction: UL System C-AJ-8055; Specified Technologies Inc. SSP Firestop Putty.
5) 2 Hour Construction: UL System C-AJ-8093; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
6) 2 Hour Construction: UL System C-AJ-8114; Specified Technologies Inc. SSM Mortar.
7) 2 Hour Construction: UL System C-AJ-8115; Specified Technologies Inc. SSM Mortar.
8) 2 Hour Construction: UL System C-AJ-8181; Specified Technologies Inc. Composite Sheet.
9) 2 Hour Construction: UL System C-AJ-8220; Specified Technologies Inc. SSM Mortar.

b. Bathtub Drains:
1) Up to 3 Hour Construction: UL System F-A-1037, F-A-1038, F-A-2094, or F-A-2095; Hilti CP 681 Tub Box Kit.
2) Up to 3 Hour Construction: UL System F-A-2183; HoldRite HydroFlame HFPTB-NP-0200, HFPTB-TW-0200, TB-NP-0200, or TB-TW-0200.

c. Uninsulated Metallic Pipe, Conduit, and Tubing:
1) Up to 4 Hour Construction: UL System C-AJ-1739; HoldRite HydroFlame 300 CG (Caulk Grade - Walls or Floors) Silicone Firestop Sealant.
2) 2 and 3 Hour Construction: UL System C-AJ-1696; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-1090; Specified Technologies Inc. SSP Firestop Putty.

4) 2 Hour Construction: UL System C-AJ-1198; Specified Technologies Inc. SIL Silicone Sealant.
5) 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
6) 2 Hour Construction: UL System C-AJ-1240; Specified Technologies Inc. LC Endothermic Firestop Sealant.
7) 2 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.

d. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
1) 2 and 3 Hour Construction: UL System C-AJ-2843; HoldRite HydroFlame Pipe Collar.
2) 2 Hour Construction: UL System C-AJ-2167; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
4) 2 Hour Construction: UL System C-AJ-2106; Specified Technologies Inc. SSW Wrap Strips.
5) 2 Hour Construction: UL System C-AJ-2282; Specified Technologies Inc. SSW Wrap Strips.
6) 2 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSC Collars.
7) 2 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSW Wrap Strips.
8) 2 Hour Construction: UL System C-AJ-2298; Specified Technologies Inc. LCC Intumescent Firestop Collars.
9) 2 Hour Construction: UL System C-AJ-2588; Specified Technologies Inc. RTC Range-Taking Collar.
10) 2 Hour Construction: UL System C-AJ-2772; Specified Technologies Inc. SSW Wrap Strips.
11) 2 Hour Construction: UL System C-BJ-2021; Hilti CP 643N Firestop Collar.

e. Electrical Cables Not In Conduit:
1) 2 Hour Construction: UL System C-AJ-3213; Specified Technologies Inc. LCC Intumescent Firestop Collars.
2) 2 Hour Construction: UL System C-AJ-3213; Specified Technologies Inc. SSC Collars.
3) 2 Hour Construction: UL System W-J-3046; Specified Technologies Inc. SSP Firestop Putty.
4) 2 Hour Construction: UL System C-AJ-3154; Specified Technologies Inc. SSP Firestop Putty.
5) 2 Hour Construction: UL System C-AJ-3375; HoldRite HydroFlame 300 CG (Caulk Grade) Silicone Firestop Sealant.
6) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
7) 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit.
8) 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.
9) 2 Hour Construction: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
10) 2 Hour Construction: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.

f. Low Voltage Cables Not In Conduit:
1) 2 Hour Construction: UL System C-AJ-3283; Hilti CP653 Speed Sleeve.
2) 2 Hour Construction: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

g. Cable Trays with Electrical Cables:
1) 2 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.

h. Insulated Pipes:
1) 2 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, CP 604

Self-Leveling Firestop Sealant or CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.

2) 2 Hour Construction: UL System C-AJ-5087; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX Intumescent Firestop Sealant.
4) 2 Hour Construction: UL System C-AJ-5138; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
5) 2 Hour Construction: UL System C-AJ-5313; Specified Technologies Inc. LC Endothermic Firestop Sealant.
6) 2 Hour Construction: UL System C-AJ-5433; HoldRite HydroFlame 300 CG (Caulk Grade).

i. HVAC Ducts, Uninsulated:
1) 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System C-AJ-7224; HoldRite HydroFlame 300 SL (Floors Only), or HoldRite HydroFlame 300 CG (Walls or Floors).
3) 2 Hour Construction: UL System C-AJ-7222; HoldRite HydroFlame 300 CG (Caulk Grade).

3. Penetrations Through Floors By:
a. Multiple Penetrations in Large Openings:
1) 2 Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.

b. Uninsulated Metallic Pipe, Conduit, and Tubing:
1) 2 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.
2) 2 Hour Construction: UL System F-A-1110; Specified Technologies Inc. CID Cast-In Device.
3) 2 Hour Construction: UL System F-A-1129; Specified Technologies Inc. Closet Flange Firestop Gasket.

c. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
1) 2 and 3 Hour Construction: UL System F-A-1133; HoldRite HydroFlame HFP-Px, HFP-PxB Cast-In Device.
2) 2 Hour Construction: UL System F-A-2065; Hilti CP 680-P Cast-In Device.
3) 2 Hour Construction: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
4) 2 Hour Construction: UL System F-A-2053; Hilti CP 680-P Cast-In Device.
5) 2 Hour Construction: UL System F-A-2216; Specified Technologies Inc. Closet Flange Firestop Gasket.
6) 2 Hour Construction: UL System F-A-2246; Specified Technologies Inc. CID Cast-In Device.

d. Electrical Cables Not In Conduit:
1) 2 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
2) 2 Hour Construction: UL System F-A-3032; Specified Technologies Inc. Ready Split Sleeve.

e. Low Voltage Cables Not In Conduit:
1) 3 Hour Construction: UL System F-A-3052; HoldRite HydroFlame HFP-Px, HFP-PxB, HFP-Mx, or HFP-MxB Cast-In Device.
2) 2 Hour Construction: UL System F-A-3058; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.

f. Electrical Busways:
1) 2 Hour Construction: UL System F-A-6002; Hilti CP 604 Self-Leveling Firestop Sealant.

g. Insulated Pipes:
1) 2 and 3 Hour Construction: UL System F-A-5043; HoldRite HydroFlame HFP-Px, or HFP-PxB Cast-In Device.
2) 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.

3) 2 Hour Construction: UL System F-A-5017; Hilti CP 680-P/M Cast-In Device.
4) 2 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID Cast-In Device.
5) 2 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID Cast-In Device.

4. Penetrations Through Walls By:
   a. Uninsulated Metallic Pipe, Conduit, and Tubing:
      1) 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      2) 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. Electrical Cables Not In Conduit:
      1) 2 Hour Construction: UL System C-AJ-3357; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      2) 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      3) 2 Hour Construction: UL System W-J-3090; Specified Technologies Inc. SSP Firestop Putty.
      4) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
      5) 2 Hour Construction: UL System W-J-3090; Specified Technologies Inc. SSP Firestop Putty.
      6) 2 Hour Construction: UL System C-AJ-3357; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      7) 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      8) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
      9) 2 Hour Construction: UL System W-J-3090; Specified Technologies Inc. SSP Firestop Putty.
      10) 2 Hour Construction: UL System W-J-3141; Specified Technologies Inc. Ready-Sleeve.
      11) 2 Hour Construction: UL System W-J-3156; Specified Technologies Inc. Ready Split Sleeve.
      12) 2 Hour Construction: UL System W-J-3182; Specified Technologies Inc. Ready Split Sleeve.
      13) 2 Hour Construction: UL System W-J-3182; Specified Technologies Inc. Ready-Sleeve.
   c. Low Voltage Cables Not In Conduit:
      1) 2 Hour Construction: UL System W-J-3098; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
      2) 2 Hour Construction: UL System W-J-3130; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
      3) 2 Hour Construction: UL System W-J-3138; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
      4) 2 Hour Construction: UL System W-J-3158; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
      5) 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      6) 2 Hour Construction: UL System W-J-3180; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   d. Insulated Pipes:
      1) 2 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      2) 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

3) 2 Hour Construction: UL System C-AJ-5407; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4) 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
5) 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

e. HVAC Ducts, Uninsulated:
1) 2 Hour Construction: UL System W-J-7092; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
2) 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant, or CP 606 Flexible Firestop Sealant.

f. HVAC Ducts, Insulated:
1) 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

D. FIRESTOPPING PENETRATIONS THROUGH FRAMED FLOORS

1. Metallic Pipe, Conduit, and Tubing Penetrations in Framed Floors:
a. 1 and 2 Hour Construction: UL System F-C-1177; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
b. 1 Hour Construction: UL System F-C-1053; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
c. 1 Hour Construction: UL System F-C-1162; Specified Technologies Inc. Closet Flange Firestop Gasket.

2. Non-Metallic Pipe, Conduit or Tubing in Framed Floors:
a. 2 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
b. 2 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC collars.
c. 2 Hour Construction: UL System F-C-2348; Specified Technologies Inc. RTC Range-Taking Collar.
d. 2 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.
e. 1 and 2 Hour Construction: UL System F-C-2473; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
f. 1 Hour Construction: UL System F-C-2487; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
g. 1 Hour Construction: UL System F-C-2014; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
h. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
i. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC Collars.
j. 1 Hour Construction: UL System F-C-2348; Specified Technologies Inc. RTC Range-Taking Collar.
k. 1 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.

3. Electrical Cable in Framed Floors:
a. 1 Hour Construction: UL System F-C-3010; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
b. 1 and 2 Hour Construction: UL System F-C-3121; HoldRite HydroFlame 200 Intumescent Firestop Sealant.

4. Insulated Pipe in Framed Floors:
a. 2 Hour Construction: UL System F-C-5090; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
b. 1 Hour Construction: UL System F-C-5043; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).

5. FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS
   a. Blank Openings:
      1) 2 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      2) 2 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.
      3) 2 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
      4) 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
      5) 1 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      6) 1 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.
      7) 1 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
         (a) 2 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
      8) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   b. Penetrations By:
      1) Multiple Penetrations in Large Openings:
         (a) 2 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         (b) 2 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
         (c) 2 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
         (d) 2 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
         (e) 2 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         (f) 2 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
         (g) 2 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         (h) 1 and 2 Hour Construction: UL System W-L-1568; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
         (i) 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         (j) 1 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
         (k) 1 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
         (l) 1 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop pillows.
         (m) 1 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         (n) 1 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
         (o) 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      2) Uninsulated Metallic Pipe, Conduit, and Tubing:
         (a) 2 Hour Construction: UL System W-L-1033; Specified Technologies Inc. SIL Silicone Sealant.
         (b) 2 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
         (c) 2 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.

(d) 2 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(g) 2 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(h) 2 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
(i) 2 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
(j) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
(k) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(l) 1 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(m) 1 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(n) 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(o) 1 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(p) 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(q) 1 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(r) 1 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.

3) Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
(a) 2 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
(b) 2 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.
(c) 2 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
(d) 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
(f) 2 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(g) 2 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
(h) 2 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC Range-Taking Collar.
(i) 1 and 2 Hour Construction: UL System W-L-2710; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(j) 1 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
(k) 1 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.
(l) 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
(m) 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(n) 1 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.

(o) 1 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(p) 1 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
(q) 1 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC Range-Taking Collar.

4) Electrical Cables Not In Conduit:
(a) 2 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
(b) 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
(c) 2 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(d) 2 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(e) 2 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
(f) 2 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(g) 2 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
(h) 2 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(i) 2 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.
(j) 2 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
(k) 2 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
(l) 2 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
(m) 2 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.
(n) 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit.
(o) 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.
(p) 2 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.
(q) 1 and 2 Hour Construction: UL System W-L-3453; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(r) 1 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
(s) 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
(t) 1 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(u) 1 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(v) 1 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
(w) 1 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.

(x) 1 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
(y) 1 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(z) 1 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.
(aa) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
(bb) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
(cc) 1 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
(dd) 1 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.
(ee) 1 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.

5) Low Voltage Cable Not In Conduit:
(a) 2 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(b) 2 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(c) 2 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(d) 2 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(e) 2 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(f) 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
(g) 2 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.
(h) 2 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
(i) 2 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(j) 2 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(k) 2 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.
(l) 2 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
(m) 2 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(n) 2 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
(o) 2 Hour Construction: UL System W-L-3395; Hilti CP653 Speed Sleeve.
(p) 1 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(q) 1 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(r) 1 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(s) 1 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.

(t) 1 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(u) 1 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(v) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
(w) 1 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.
(x) 1 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
(y) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(z) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(aa) 1 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.
(bb) 1 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
(cc) 1 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(dd) 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

6) Cable Trays with Electrical Cables:
(a) 2 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(b) 2 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
(c) 2 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(d) 1 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(e) 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
(f) 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.

7) Insulated Pipes:
(a) 2 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(c) 2 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
(d) 2 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(g) 1 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(h) 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(i) 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
(j) 1 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.

(k) 1 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(l) 1 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(m) 1 and 2 Hour Construction: UL System W-L-5357; HoldRite HydroFlame 200 Intumescent Firestop Sealant.

8) HVAC Ducts, Insulated:
(a) 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(c) 2 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(d) 1 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(e) 1 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(f) 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.07 ***SPECIFIER NOTE: KEEP BELOW FOR 3 HOUR AND LOWER RATED ASSEMBLIES.***

2.08 FIRESTOPPING FOR (3) THREE HOUR AND LOWER RATED ASSEMBLIES

A. FIRESTOPPING FOR PERIMETER CONTAINMENT
1. Perimeter Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
a. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. AS200 Elastomeric Spray.
b. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. Fast Tack Firestop Spray.
c. 2 Hour Construction: UL System CW-S-0003; Specified Technologies Inc. Fast Tack Firestop Spray.
d. 2 Hour Construction: UL System CW-S-0007; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
2. Perimeter Joint Systems That Have Movement Capabilities (Dynamic-D):
a. 3 Hour Construction: UL System CW-D-2005; Specified Technologies Inc. Fast Tack Firestop Spray.
b. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. AS200 Elastomeric Spray.
c. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. Fast Tack Firestop Spray.
d. 2 Hour Construction: UL System CW-D-1011; Specified Technologies Inc. Fast Tack Firestop Spray.
e. 2 Hour Construction: UL System CW-D-2042; Specified Technologies Inc. Fast Tack Firestop Spray.

B. FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS
1. Concrete and Concrete Masonry Walls and Floors:
a. Floor-to-Floor Joints:
1) 3 Hour Construction: UL System FF-D-1001; Specified Technologies Inc. SIL Silicone Sealant.
2) 3 Hour Construction: UL System FF-D-1008; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3) 3 Hour Construction: UL System FF-D-1025; Specified Technologies Inc. AS200 Elastomeric Spray.

4) 2 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

b. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
1) 3 Hour Construction: UL System HW-D-0139; Specified Technologies Inc. AS200 Elastomeric Spray.
2) 2 Hour Construction: UL System HW-D-0039; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3) 2 Hour Construction: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
4) 2 Hour Construction: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

c. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor:
1) 3 Hour Construction: UL System HW-D-0041; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
2) 3 Hour Construction: UL System HW-D-0312; Specified Technologies Inc. SIL Silicone Sealant.
3) 3 Hour Construction: UL System HW-D-1034; Specified Technologies Inc. AS200 Elastomeric Spray.
4) 3 Hour Construction: UL System HW-D-1058; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
5) 2 Hour Construction: UL System HW-D-0268; Hilti CP 606 Flexible Firestop Sealant.
6) 2 Hour Construction: UL System HW-D-0312; Specified Technologies Inc. SIL Silicone Sealant.

d. Concrete/Concrete Masonry Wall-to-Wall Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
1) 3 Hour Construction: UL System WW-S-0038; Specified Technologies Inc. SIL Silicone Sealant.
2) 3 Hour Construction: UL System WW-S-0049; Specified Technologies Inc. SIL Silicone Sealant.

e. Concrete/Concrete Masonry Wall-to-Wall Joint Systems That Have Movement Capabilities (Dynamic-D):
1) 3 Hour Construction: UL System WW-D-1001; Specified Technologies Inc. SIL Silicone Sealant.
2) 3 Hour Construction: UL System WW-D-1007; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3) 3 Hour Construction: UL System WW-D-1037; Specified Technologies Inc. AS200 Elastomeric Spray.
4) 2 Hour Construction: UL System WW-D-0017; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
5) 2 Hour Construction: UL System WW-D-0032; Hilti CP 606 Flexible Firestop Sealant.

2. Gypsum Board Walls:
a. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
1) 2 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
2) 1 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

b. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
1) 2 Hour Construction: UL System WW-D-0180; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
2) 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
3) 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

c. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:

1) 2 Hour Construction: UL System HW-D-0252; Specified Technologies Inc. AS200 Elastomeric Spray.
2) 2 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
3) 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

d. Head-of-Wall Joints at Underside of Flat Concrete:
1) 2 Hour Construction: UL System HW-D-0044; Specified Technologies Inc. AS200 Elastomeric Spray.
2) 2 Hour Construction: UL System HW-D-0079; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3) 2 Hour Construction: UL System HW-D-0371; Specified Technologies Inc. SpeedFlex Joint Profile System.
4) 2 Hour Construction: UL System HW-D-0689; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
5) 2 Hour Construction: UL System HW-D-0696; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
6) 2 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
7) 2 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.
8) 1 Hour Construction: UL System HW-D-0079; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
9) 1 Hour Construction: UL System HW-D-0371; Specified Technologies Inc. SpeedFlex Joint Profile System.
10) 1 Hour Construction: UL System HW-D-0689; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
11) 1 Hour Construction: UL System HW-D-0696; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
12) 1 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
13) 1 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.

e. Head-of-Wall Joints at Concrete Over Metal Deck:
1) 2 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
2) 2 Hour Construction: UL System HW-D-0043; Specified Technologies Inc. AS200 Elastomeric Spray.
3) 2 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
4) 2 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.
5) 2 Hour Construction: UL System HW-D-0365; Specified Technologies Inc. SpeedFlex Joint Profile System.
6) 2 Hour Construction: UL System HW-D-0548; Specified Technologies Inc. SpeedFlex Joint Profile System.
7) 2 Hour Construction: UL System HW-D-0749; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
8) 1 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
9) 1 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
10) 1 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.

11) 1 Hour Construction: UL System HW-D-0365; Specified Technologies Inc. SpeedFlex Joint Profile System.
12) 1 Hour Construction: UL System HW-D-0548; Specified Technologies Inc. SpeedFlex Joint Profile System.
13) 1 Hour Construction: UL System HW-D-0749; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

f. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
1) 2 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2) 2 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
4) 1 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.

g. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
1) 2 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
2) 2 Hour Construction: UL System HW-D-0103; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

h. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
1) 2 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2) 2 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
4) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

C. FIRESTOPPING FOR FLOOR-TO-WALL MOVABLE JOINTS
1. Floor-To-Wall Joint System That Have Movement Capabilities (Dynamic-D):
a. 3 Hour Construction: UL System FW-D-1001; Specified Technologies Inc. SIL Silicone Sealant.
b. 3 Hour Construction: UL System FW-D-1007; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
c. 3 Hour Construction: UL System FW-D-1035; Specified Technologies Inc. AS200 Elastomeric Spray.

D. FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION
1. Blank Openings:
a. In Floors or Walls:
1) 3 Hour Construction: UL System F-A-0031; Specified Technologies Inc. CID Cast-In Devices.
2) 3 Hour Construction: UL System C-AJ-0015; Specified Technologies Inc. SSM Mortar.
3) 3 Hour Construction: UL System C-AJ-0061; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
4) 3 Hour Construction: UL System C-AJ-0113; Specified Technologies Inc. Composite Sheet.
5) 3 Hour Construction: UL System C-AJ-0135; Specified Technologies Inc. FP Intumescent Firestop Plug.
6) 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
7) 2 Hour Construction: UL System C-AJ-0015; Specified Technologies Inc. SSM Mortar.
8) 2 Hour Construction: UL System C-AJ-0116; Specified Technologies Inc. Composite Sheet.
9) 2 Hour Construction: UL System C-AJ-0136; Specified Technologies Inc. SSM Mortar.
10) 2 Hour Construction: UL System C-AJ-0171; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
11) 2 Hour Construction: UL System C-AJ-0175; HoldRite HydroFlame 300 SL (Self-Leveling) Silicone Firestop Sealant.

2. Penetrations Through Floors or Walls By:
    a. Multiple Penetrations in Large Openings:
        1) 2 Hour Construction: UL System C-AJ-2863; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
        2) 3 Hour Construction: UL System C-AJ-8016; Specified Technologies Inc. SSM Mortar.
        3) 3 Hour Construction: UL System C-AJ-8035; Specified Technologies Inc. SSM Mortar.
        4) 3 Hour Construction: UL System C-AJ-8093; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
        5) 3 Hour Construction: UL System C-AJ-8181; Specified Technologies Inc. Composite Sheet.
        6) 3 Hour Construction: UL System C-AJ-8099; Hilti FS-ONE MAX Intumescent Firestop Sealant.
        7) 3 Hour Construction: UL System C-AJ-8110; Hilti CFS-BL Firestop Block.
        8) 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
        9) 2 Hour Construction: UL System C-AJ-8035; Specified Technologies Inc. SSM Mortar.
        10) 2 Hour Construction: UL System C-AJ-8055; Specified Technologies Inc. SSP Firestop Putty.
        11) 2 Hour Construction: UL System C-AJ-8093; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
        12) 2 Hour Construction: UL System C-AJ-8114; Specified Technologies Inc. SSM Mortar.
        13) 2 Hour Construction: UL System C-AJ-8115; Specified Technologies Inc. SSM Mortar.
        14) 2 Hour Construction: UL System C-AJ-8181; Specified Technologies Inc. Composite Sheet.
        15) 2 Hour Construction: UL System C-AJ-8220; Specified Technologies Inc. SSM Mortar.
    b. Bathtub Drains:
        1) Up to 3 Hour Construction: UL System F-A-1037, F-A-1038, F-A-2094, or F-A-2095; Hilti CP 681 Tub Box Kit.
        2) Up to 3 Hour Construction: UL System F-A-2183; HoldRite HydroFlame HFPTB-NP-0200, HFPTB-TW-0200, TB-NP-0200, or TB-TW-0200.
    c. Uninsulated Metallic Pipe, Conduit, and Tubing:
        1) Up to 4 Hour Construction: UL System C-AJ-1739; HoldRite HydroFlame 300 CG (Caulk Grade - Walls or Floors) Silicone Firestop Sealant.
        2) 3 Hour Construction: UL System C-AJ-1079; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
        3) 3 Hour Construction: UL System C-AJ-1089; Specified Technologies Inc. SSM Mortar.
        4) 3 Hour Construction: UL System C-AJ-1184; Hilti FS-ONE MAX Intumescent Firestop Sealant.
        5) 3 Hour Construction: UL System C-AJ-1198; Specified Technologies Inc. SIL Silicone Sealant.
        6) 3 Hour Construction: UL System C-AJ-1215; Specified Technologies Inc. LC Endothermic Firestop Sealant.
        7) 3 Hour Construction: UL System C-AJ-1217; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
        8) 3 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
        9) 3 Hour Construction: UL System C-AJ-1353; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
        10) 3 Hour Construction: UL System C-AJ-1421; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 604 Self-Leveling Firestop Sealant.
        11) 3 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
        12) 3 Hour Construction: UL System C-AJ-1718; HoldRite HydroFlame 200 Intumescent Firestop Sealant.

13) 2 and 3 Hour Construction: UL System C-AJ-1696; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
14) 2 Hour Construction: UL System C-AJ-1090; Specified Technologies Inc. SSP Firestop Putty.
15) 2 Hour Construction: UL System C-AJ-1198; Specified Technologies Inc. SIL Silicone Sealant.
16) 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
17) 2 Hour Construction: UL System C-AJ-1240; Specified Technologies Inc. LC Endothermic Firestop Sealant.
18) 2 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.

d. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
1) 3 Hour Construction: UL System C-AJ-2842; HoldRite HydroFlame Pipe Collar.
2) 3 Hour Construction: UL System C-AJ-2848; HoldRite HydroFlame Wrap Strip and HydroFlame 200 Intumescent Firestop Sealant.
3) 3 Hour Construction: UL System C-AJ-2851; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4) 3 Hour Construction: UL System C-AJ-2106; Specified Technologies Inc. SSW Wrap Strips.
5) 3 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
6) 3 Hour Construction: UL System C-AJ-2220; Hilti FS-ONE MAX Intumescent Firestop Sealant.
7) 3 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSC Collars.
8) 3 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSW Wrap Strips.
9) 3 Hour Construction: UL System C-AJ-2342; Hilti CP-E/S Firestop Wrap Strip.
10) 2 and 3 Hour Construction: UL System C-AJ-2843; HoldRite HydroFlame Pipe Collar.
11) 2 Hour Construction: UL System C-AJ-2167; Hilti FS-ONE MAX Intumescent Firestop Sealant.
12) 2 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
13) 2 Hour Construction: UL System C-AJ-2106; Specified Technologies Inc. SSW Wrap Strips.
14) 2 Hour Construction: UL System C-AJ-2282; Specified Technologies Inc. SSW Wrap Strips.
15) 2 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSC Collars.
16) 2 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSW Wrap Strips.
17) 2 Hour Construction: UL System C-AJ-2298; Specified Technologies Inc. LCC Intumescent Firestop Collars.
18) 2 Hour Construction: UL System C-AJ-2588; Specified Technologies Inc. RTC Range-Taking Collar.
19) 2 Hour Construction: UL System C-AJ-2772; Specified Technologies Inc. SSW Wrap Strips.
20) 2 Hour Construction: UL System C-BJ-2021; Hilti CP 643N Firestop Collar.

e. Electrical Cables Not In Conduit:
1) 3 Hour Construction: UL System C-AJ-3085; Specified Technologies Inc. LC Endothermic Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 3 Hour Construction: UL System C-AJ-3154; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
4) 3 Hour Construction: UL System C-AJ-3208; Hilti CP 618 Firestop Putty Stick.

5) 3 Hour Construction: UL System C-AJ-3312; Specified Technologies Inc. FP Intumescent Firestop Plug.
6) 3 Hour Construction: UL System C-AJ-3360; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
7) 2 Hour Construction: UL System C-AJ-3213; Specified Technologies Inc. LCC Intumescent Firestop Collars.
8) 2 Hour Construction: UL System C-AJ-3213; Specified Technologies Inc. SSC Collars.
9) 2 Hour Construction: UL System W-J-3046; Specified Technologies Inc. SSP Firestop Putty.
10) 2 Hour Construction: UL System C-AJ-3154; Specified Technologies Inc. SSP Firestop Putty.
11) 2 Hour Construction: UL System C-AJ-3375; HoldRite HydroFlame 300 CG (Caulk Grade) Silicone Firestop Sealant.
12) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
13) 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit.
14) 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.
15) 2 Hour Construction: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
16) 2 Hour Construction: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.

f. Low Voltage Cables Not In Conduit:
1) 3 Hour Construction: UL System C-AJ-3231; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
2) 2 Hour Construction: UL System C-AJ-3283; Hilti CP653 Speed Sleeve.
3) 2 Hour Construction: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

g. Cable Trays with Electrical Cables:
1) 3 Hour Construction: UL System C-AJ-4029; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
2) 3 Hour Construction: UL System C-AJ-4093; Hilti CFS-BL Firestop Block.
3) 2 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.

h. Electrical Busways:
1) 3 Hour Construction: UL System C-AJ-6017; Hilti FS-ONE MAX Intumescent Firestop Sealant.

i. Insulated Pipes:
1) 3 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-5410; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
3) 3 Hour Construction: UL System C-AJ-5436; HoldRite HydroFlame 300 SL (Floors Only), or HoldRite HydroFlame 300 CG (Walls or Floors).
4) 2 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, CP 604 Self-Leveling Firestop Sealant or CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
5) 2 Hour Construction: UL System C-AJ-5087; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
6) 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX Intumescent Firestop Sealant.
7) 2 Hour Construction: UL System C-AJ-5138; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
8) 2 Hour Construction: UL System C-AJ-5313; Specified Technologies Inc. LC Endothermic Firestop Sealant.

9) 2 Hour Construction: UL System C-AJ-5433; HoldRite HydroFlame 300 CG (Caulk Grade).

j. HVAC Ducts, Uninsulated:
1) 3 Hour Construction: UL System C-AJ-7051; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-7204; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.
4) 2 Hour Construction: UL System C-AJ-7224; HoldRite HydroFlame 300 SL (Floors Only), or HoldRite HydroFlame 300 CG (Walls or Floors).
5) 2 Hour Construction: UL System C-AJ-7222; HoldRite HydroFlame 300 CG (Caulk Grade).

3. Penetrations Through Floors By:
a. Multiple Penetrations in Large Openings:
1) 3 Hour Construction: UL System F-A-1023; Hilti CP 680-P/M Cast-In Device.
2) 3 Hour Construction: UL System F-A-3052; HoldRite HydroFlame HFP-Px, HFP-PxB, HFP-Mx, or HFP-MxB Cast-In Device.
3) 3 Hour Construction: UL System F-A-8034; HoldRite HydroFlame HFP-P3, or HFP-P3B Cast-In Device.
4) 2 Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.

b. Uninsulated Metallic Pipe, Conduit, and Tubing:
1) 3 Hour Construction: UL System F-A-1017; Hilti CP 680-P/M Cast-In Device.
2) 3 Hour Construction: UL System F-A-1110; Specified Technologies Inc. CID Cast-In Device.
3) 3 Hour Construction: UL System F-B-1038; HoldRite HydroFlame HFP-M/P8, HFP-M/P10, or HFP-M/P12 Cast-In Device.
4) 2 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.
5) 2 Hour Construction: UL System F-A-1110; Specified Technologies Inc. CID Cast-In Device.
6) 2 Hour Construction: UL System F-A-1129; Specified Technologies Inc. Closet Flange Firestop Gasket.

c. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
1) 3 Hour Construction: UL System F-A-2054; Hilti CP 680-P Cast-In Device.
2) 3 Hour Construction: UL System F-A-2066; Hilti CP 680-P Cast-In Device.
3) 3 Hour Construction: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
4) 3 Hour Construction: UL System F-A-2192; Specified Technologies Inc. CID Cast-In Device.
5) 3 Hour Construction: UL System F-A-2246; Specified Technologies Inc. CID Cast-In Device.
6) 3 Hour Construction: UL System F-B-1038; HoldRite HydroFlame HFP-P8, HFP-P10, or HFP-P12 Cast-In Device.
7) 2 and 3 Hour Construction: UL System F-A-1133; HoldRite HydroFlame HFP-Px, HFP-PxB Cast-In Device.
8) 2 Hour Construction: UL System F-A-2065; Hilti CP 680-P Cast-In Device.
9) 2 Hour Construction: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
10) 2 Hour Construction: UL System F-A-2053; Hilti CP 680-P Cast-In Device.
11) 2 Hour Construction: UL System F-A-2216; Specified Technologies Inc. Closet Flange Firestop Gasket.
12) 2 Hour Construction: UL System F-A-2246; Specified Technologies Inc. CID Cast-In Device.

d. Electrical Cables Not In Conduit:

1) 3 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
2) 3 Hour Construction: UL System F-A-3052; HoldRite HydroFlame HFP-Px, HFP-PxB, HFP-Mx, or HFP-MxB Cast-In Device.
3) 2 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
4) 2 Hour Construction: UL System F-A-3032; Specified Technologies Inc. Ready Split Sleeve.

e. Low Voltage Cables Not In Conduit:
1) 3 Hour Construction: UL System F-A-3021; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
2) 3 Hour Construction: UL System F-A-3037; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
3) 3 Hour Construction: UL System F-A-3054; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
4) 2 Hour Construction: UL System F-A-3058; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.

f. Electrical Busways:
1) 3 Hour Construction: UL System C-AJ-6017; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.
2) 2 Hour Construction: UL System F-A-6002; Hilti CP 604 Self-Leveling Firestop Sealant.

g. Insulated Pipes:
1) 3 Hour Construction: UL System F-A-5016; Hilti CP 680-P Cast-In Device.
2) 3 Hour Construction: UL System F-A-5018; Hilti CP 680-P Cast-In Device.
3) 3 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID Cast-In Device.
4) 3 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID Cast-In Device.
5) 3 Hour Construction: UL System F-A-5013; HoldRite HydroFlame HFP-M/P8, HFP-M/P10, or HFP-M/P12 Cast-In Device.
6) 2 and 3 Hour Construction: UL System F-A-5043; HoldRite HydroFlame HFP-Px, or HFP-PxB Cast-In Device.
7) 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.
8) 2 Hour Construction: UL System F-A-5017; Hilti CP 680-P/M Cast-In Device.
9) 2 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID Cast-In Device.
10) 2 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID Cast-In Device.

4. Penetrations Through Walls By:
a. Uninsulated Metallic Pipe, Conduit, and Tubing:
1) 3 Hour Construction: UL System C-AJ-1700; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.

b. Electrical Cables Not In Conduit:
1) 2 Hour Construction: UL System C-AJ-3357; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
4) 2 Hour Construction: UL System W-J-3090; Specified Technologies Inc. SSP Firestop Putty.

5) 2 Hour Construction: UL System C-AJ-3357; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
6) 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
7) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
8) 2 Hour Construction: UL System W-J-3090; Specified Technologies Inc. SSP Firestop Putty.
9) 2 Hour Construction: UL System W-J-3141; Specified Technologies Inc. Ready-Sleeve.
10) 2 Hour Construction: UL System W-J-3156; Specified Technologies Inc. Ready Split Sleeve.
11) 2 Hour Construction: UL System W-J-3182; Specified Technologies Inc. Ready Split Sleeve.
12) 2 Hour Construction: UL System W-J-3182; Specified Technologies Inc. Ready-Sleeve.

c. Low Voltage Cables Not In Conduit:
1) 2 Hour Construction: UL System W-J-3098; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
2) 2 Hour Construction: UL System W-J-3130; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
3) 2 Hour Construction: UL System W-J-3138; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
4) 2 Hour Construction: UL System W-J-3158; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
5) 2 Hour Construction: UL System W-J-3180; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.

d. Insulated Pipes:
1) 2 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-5407; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4) 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
5) 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

e. HVAC Ducts, Uninsulated:
1) 3 Hour Construction: UL System C-AJ-7204; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System W-J-7092; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
3) 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant, or CP 606 Flexible Firestop Sealant.

f. HVAC Ducts, Insulated:
1) 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

E. FIRESTOPPING PENETRATIONS THROUGH FRAMED FLOORS
1. Metallic Pipe, Conduit, and Tubing Penetrations in Framed Floors:
a. 1 and 2 Hour Construction: UL System F-C-1177; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
b. 1 Hour Construction: UL System F-C-1053; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
2. Non-Metallic Pipe, Conduit or Tubing in Framed Floors:

a. 2 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
b. 2 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC collars.
c. 2 Hour Construction: UL System F-C-2348; Specified Technologies Inc. RTC Range-Taking Collar.
d. 2 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.
e. 1 and 2 Hour Construction: UL System F-C-2473; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
f. 1 Hour Construction: UL System F-C-2487; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
g. 1 Hour Construction: UL System F-C-2014; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
h. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
i. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC Collars.
j. 1 Hour Construction: UL System F-C-2348; Specified Technologies Inc. RTC Range-Taking Collar.
k. 1 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.

3. Electrical Cable in Framed Floors:
   a. 1 Hour Construction: UL System F-C-3010; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
   b. 1 and 2 Hour Construction: UL System F-C-3121; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4. Insulated Pipe in Framed Floors:
   a. 2 Hour Construction: UL System F-C-5090; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   b. 1 Hour Construction: UL System F-C-5043; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
5. FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS
   a. Blank Openings:
      1) 3 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      2) 2 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      3) 2 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.
      4) 2 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
      5) 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
      6) 1 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      7) 1 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.
      8) 1 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
      9) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   b. Penetrations By:
      1) Multiple Penetrations in Large Openings:
         (a) 2 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
         (b) 2 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
         (c) 2 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.

(d) 2 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(e) 2 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
(g) 2 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(h) 1 and 2 Hour Construction: UL System W-L-1568; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
(i) 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(j) 1 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
(k) 1 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(l) 1 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop pillows.
(m) 1 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(n) 1 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
(o) 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2) Uninsulated Metallic Pipe, Conduit, and Tubing:
(a) 3 and 4 Hour Construction: UL System W-L-1560; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-1033; Specified Technologies Inc. SIL Silicone Sealant.
(c) 2 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(d) 2 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(g) 2 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(h) 2 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(i) 2 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
(j) 2 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
(k) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
(l) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(m) 1 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(n) 1 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(o) 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.

(p) 1 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(q) 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(r) 1 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(s) 1 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
(t) 1 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.

3) Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
(a) 2 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
(b) 2 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.
(c) 2 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
(d) 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
(f) 2 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(g) 2 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
(h) 2 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC Range-Taking Collar.
(i) 1 and 2 Hour Construction: UL System W-L-2710; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(j) 1 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
(k) 1 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.
(l) 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
(m) 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(n) 1 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
(o) 1 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(p) 1 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
(q) 1 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC Range-Taking Collar.

4) Electrical Cables Not In Conduit:
(a) 3 Hour Construction: UL System W-L-3276; Specified Technologies Inc. Ready-Sleeve.
(b) 3 Hour Construction: UL System W-L-3304; Specified Technologies Inc. Ready Split Sleeve.
(c) 2 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
(d) 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
(e) 2 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.

(f) 2 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(g) 2 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
(h) 2 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(i) 2 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
(j) 2 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(k) 2 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.
(l) 2 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
(m) 2 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
(n) 2 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
(o) 2 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.
(p) 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit.
(q) 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.
(r) 2 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.
(s) 1 and 2 Hour Construction: UL System W-L-3453; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(t) 1 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
(u) 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
(v) 1 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(w) 1 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(x) 1 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
(y) 1 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(z) 1 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
(aa) 1 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(bb) 1 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.
(cc) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
(dd) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
(ee) 1 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
(ff) 1 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.

(gg) 1 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.

5) Low Voltage Cable Not In Conduit:
   (a) 3 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   (b) 2 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   (c) 2 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   (d) 2 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   (e) 2 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   (f) 2 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   (g) 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   (h) 2 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.
   (i) 2 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
   (j) 2 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   (k) 2 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   (l) 2 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.
   (m) 2 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
   (n) 2 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   (o) 2 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
   (p) 2 Hour Construction: UL System W-L-3395; Hilti CP653 Speed Sleeve.
   (q) 1 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   (r) 1 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   (s) 1 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   (t) 1 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   (u) 1 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   (v) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   (w) 1 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.
   (x) 1 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
   (y) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   (z) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   (aa) 1 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.

(bb) 1 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
(cc) 1 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(dd) 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

6) Cable Trays with Electrical Cables:
(a) 2 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(b) 2 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
(c) 2 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(d) 1 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(e) 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
(f) 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.

7) Insulated Pipes:
(a) 2 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(c) 2 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
(d) 2 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(g) 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(h) 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
(i) 1 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(j) 1 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(k) 1 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(l) 1 and 2 Hour Construction: UL System W-L-5357; HoldRite HydroFlame 200 Intumescent Firestop Sealant.

8) HVAC Ducts, Insulated:
(a) 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(c) 2 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(d) 1 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(e) 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.09 ***SPECIFIER NOTE: KEEP BELOW FOR 4 HOUR AND LOWER RATED ASSEMBLIES.***

2.10 FIRESTOPPING FOR (4) FOUR HOUR AND LOWER RATED ASSEMBLIES

A. FIRESTOPPING FOR PERIMETER CONTAINMENT

1. Perimeter Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
    a. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. AS200 Elastomeric Spray.
    b. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. Fast Tack Firestop Spray.
    c. 2 Hour Construction: UL System CW-S-0003; Specified Technologies Inc. Fast Tack Firestop Spray.
    d. 2 Hour Construction: UL System CW-S-0007; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
2. Perimeter Joint Systems That Have Movement Capabilities (Dynamic-D):
    a. 3 Hour Construction: UL System CW-D-2005; Specified Technologies Inc. Fast Tack Firestop Spray.
    b. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. AS200 Elastomeric Spray.
    c. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. Fast Tack Firestop Spray.
    d. 2 Hour Construction: UL System CW-D-1011; Specified Technologies Inc. Fast Tack Firestop Spray.
    e. 2 Hour Construction: UL System CW-D-2042; Specified Technologies Inc. Fast Tack Firestop Spray.

B. FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

1. Concrete and Concrete Masonry Walls and Floors:
    a. Floor-to-Floor Joints:
        1) 3 Hour Construction: UL System FF-D-1001; Specified Technologies Inc. SIL Silicone Sealant.
        2) 3 Hour Construction: UL System FF-D-1008; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
        3) 3 Hour Construction: UL System FF-D-1025; Specified Technologies Inc. AS200 Elastomeric Spray.
        4) 2 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
    b. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
        1) 2 Hour Construction: UL System HW-D-0039; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
        2) 2 Hour Construction: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
        3) 2 Hour Construction: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
    c. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor:
        1) 3 Hour Construction: UL System HW-D-0041; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
        2) 3 Hour Construction: UL System HW-D-0312; Specified Technologies Inc. SIL Silicone Sealant.
        3) 3 Hour Construction: UL System HW-D-1034; Specified Technologies Inc. AS200 Elastomeric Spray.
        4) 3 Hour Construction: UL System HW-D-1058; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
        5) 2 Hour Construction: UL System HW-D-0268; Hilti CP 606 Flexible Firestop Sealant.

6) 2 Hour Construction: UL System HW-D-0312; Specified Technologies Inc. SIL Silicone Sealant.

d. Concrete/Concrete Masonry Wall-to-Wall Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
   1) 3 Hour Construction: UL System WW-S-0038; Specified Technologies Inc. SIL Silicone Sealant.
   2) 3 Hour Construction: UL System WW-S-0049; Specified Technologies Inc. SIL Silicone Sealant.

e. Concrete/Concrete Masonry Wall-to-Wall Joint Systems That Have Movement Capabilities (Dynamic-D):
   1) 3 Hour Construction: UL System WW-D-1001; Specified Technologies Inc. SIL Silicone Sealant.
   2) 3 Hour Construction: UL System WW-D-1007; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
   3) 3 Hour Construction: UL System WW-D-1037; Specified Technologies Inc. AS200 Elastomeric Spray.
   4) 2 Hour Construction: UL System WW-D-0017; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   5) 2 Hour Construction: UL System WW-D-0032; Hilti CP 606 Flexible Firestop Sealant.

2. Gypsum Board Walls:
   a. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
      1) 2 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
      2) 1 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
   b. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
      1) 2 Hour Construction: UL System WW-D-0180; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
      2) 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
      3) 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
   c. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
      1) 2 Hour Construction: UL System HW-D-0252; Specified Technologies Inc. AS200 Elastomeric Spray.
      2) 2 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      3) 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   d. Head-of-Wall Joints at Underside of Flat Concrete:
      1) 2 Hour Construction: UL System HW-D-0044; Specified Technologies Inc. AS200 Elastomeric Spray.
      2) 2 Hour Construction: UL System HW-D-0079; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
      3) 2 Hour Construction: UL System HW-D-0371; Specified Technologies Inc. SpeedFlex Joint Profile System.
      4) 2 Hour Construction: UL System HW-D-0689; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
      5) 2 Hour Construction: UL System HW-D-0696; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
      6) 2 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      7) 2 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.

8) 1 Hour Construction: UL System HW-D-0079; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
9) 1 Hour Construction: UL System HW-D-0371; Specified Technologies Inc. SpeedFlex Joint Profile System.
10) 1 Hour Construction: UL System HW-D-0689; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
11) 1 Hour Construction: UL System HW-D-0696; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
12) 1 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
13) 1 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.

e. Head-of-Wall Joints at Concrete Over Metal Deck:
1) 2 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
2) 2 Hour Construction: UL System HW-D-0043; Specified Technologies Inc. AS200 Elastomeric Spray.
3) 2 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
4) 2 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.
5) 2 Hour Construction: UL System HW-D-0365; Specified Technologies Inc. SpeedFlex Joint Profile System.
6) 2 Hour Construction: UL System HW-D-0548; Specified Technologies Inc. SpeedFlex Joint Profile System.
7) 2 Hour Construction: UL System HW-D-0749; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
8) 1 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
9) 1 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
10) 1 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.
11) 1 Hour Construction: UL System HW-D-0365; Specified Technologies Inc. SpeedFlex Joint Profile System.
12) 1 Hour Construction: UL System HW-D-0548; Specified Technologies Inc. SpeedFlex Joint Profile System.
13) 1 Hour Construction: UL System HW-D-0749; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

f. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
1) 2 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2) 2 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
4) 1 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.

g. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
1) 2 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
2) 2 Hour Construction: UL System HW-D-0103; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

h. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
1) 2 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

2) 2 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
3) 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
4) 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

C. FIRESTOPPING FOR FLOOR-TO-WALL MOVABLE JOINTS
1. Floor-To-Wall Joint System That Have Movement Capabilities (Dynamic-D):
a. 3 Hour Construction: UL System FW-D-1001; Specified Technologies Inc. SIL Silicone Sealant.
b. 3 Hour Construction: UL System FW-D-1007; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
c. 3 Hour Construction: UL System FW-D-1035; Specified Technologies Inc. AS200 Elastomeric Spray.

D. FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION
1. Blank Openings:
a. In Floors or Walls:
1) 3 Hour Construction: UL System F-A-0031; Specified Technologies Inc. CID Cast-In Devices.
2) 3 Hour Construction: UL System C-AJ-0015; Specified Technologies Inc. SSM Mortar.
3) 3 Hour Construction: UL System C-AJ-0061; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
4) 3 Hour Construction: UL System C-AJ-0113; Specified Technologies Inc. Composite Sheet.
5) 3 Hour Construction: UL System C-AJ-0135; Specified Technologies Inc. FP Intumescent Firestop Plug.
6) 3 Hour Construction: UL System C-AJ-0176; HoldRite HydroFlame 300 CG (Caulk Grade - Walls or Floors) Silicone Firestop Sealant.
7) 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
8) 2 Hour Construction: UL System C-AJ-0015; Specified Technologies Inc. SSM Mortar.
9) 2 Hour Construction: UL System C-AJ-0116; Specified Technologies Inc. Composite Sheet.
10) 2 Hour Construction: UL System C-AJ-0136; Specified Technologies Inc. SSM Mortar.
11) 2 Hour Construction: UL System C-AJ-0171; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
12) 2 Hour Construction: UL System C-AJ-0175; HoldRite HydroFlame 300 SL (Self-Leveling) Silicone Firestop Sealant.
2. Penetrations Through Floors or Walls By:
a. Multiple Penetrations in Large Openings:
1) 2 Hour Construction: UL System C-AJ-2863; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-8016; Specified Technologies Inc. SSM Mortar.
3) 3 Hour Construction: UL System C-AJ-8035; Specified Technologies Inc. SSM Mortar.
4) 3 Hour Construction: UL System C-AJ-8093; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
5) 3 Hour Construction: UL System C-AJ-8181; Specified Technologies Inc. Composite Sheet.
6) 3 Hour Construction: UL System C-AJ-8099; Hilti FS-ONE MAX Intumescent Firestop Sealant.
7) 3 Hour Construction: UL System C-AJ-8110; Hilti CFS-BL Firestop Block.
8) 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
9) 2 Hour Construction: UL System C-AJ-8035; Specified Technologies Inc. SSM Mortar.
10) 2 Hour Construction: UL System C-AJ-8055; Specified Technologies Inc. SSP Firestop Putty.
11) 2 Hour Construction: UL System C-AJ-8093; Specified Technologies Inc. SSB Intumescent Firestop Pillows.

12) 2 Hour Construction: UL System C-AJ-8114; Specified Technologies Inc. SSM Mortar.
13) 2 Hour Construction: UL System C-AJ-8115; Specified Technologies Inc. SSM Mortar.
14) 2 Hour Construction: UL System C-AJ-8181; Specified Technologies Inc. Composite Sheet.
15) 2 Hour Construction: UL System C-AJ-8220; Specified Technologies Inc. SSM Mortar.

b. Bathtub Drains:
1) Up to 3 Hour Construction: UL System F-A-1037, F-A-1038, F-A-2094, or F-A-2095; Hilti CP 681 Tub Box Kit.
2) Up to 3 Hour Construction: UL System F-A-2183; HoldRite HydroFlame HFPTB-NP-0200, HFPTB-TW-0200, TB-NP-0200, or TB-TW-0200.

c. Uninsulated Metallic Pipe, Conduit, and Tubing:
1) Up to 4 Hour Construction: UL System C-AJ-1739; HoldRite HydroFlame 300 CG (Caulk Grade - Walls or Floors) Silicone Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-1079; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
3) 3 Hour Construction: UL System C-AJ-1089; Specified Technologies Inc. SSM Mortar.
4) 3 Hour Construction: UL System C-AJ-1184; Hilti FS-ONE MAX Intumescent Firestop Sealant.
5) 3 Hour Construction: UL System C-AJ-1198; Specified Technologies Inc. SIL Silicone Sealant.
6) 3 Hour Construction: UL System C-AJ-1215; Specified Technologies Inc. LC Endothermic Firestop Sealant.
7) 3 Hour Construction: UL System C-AJ-1217; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
8) 3 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
9) 3 Hour Construction: UL System C-AJ-1353; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
10) 3 Hour Construction: UL System C-AJ-1421; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 604 Self-Leveling Firestop Sealant.
11) 3 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
12) 3 Hour Construction: UL System C-AJ-1718; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
13) 2 and 3 Hour Construction: UL System C-AJ-1696; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
14) 2 Hour Construction: UL System C-AJ-1090; Specified Technologies Inc. SSP Firestop Putty.
15) 2 Hour Construction: UL System C-AJ-1198; Specified Technologies Inc. SIL Silicone Sealant.
16) 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
17) 2 Hour Construction: UL System C-AJ-1240; Specified Technologies Inc. LC Endothermic Firestop Sealant.
18) 2 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.

d. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
1) 3 Hour Construction: UL System C-AJ-2842; HoldRite HydroFlame Pipe Collar.
2) 3 Hour Construction: UL System C-AJ-2848; HoldRite HydroFlame Wrap Strip and HydroFlame 200 Intumescent Firestop Sealant.
3) 3 Hour Construction: UL System C-AJ-2851; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4) 3 Hour Construction: UL System C-AJ-2106; Specified Technologies Inc. SSW Wrap Strips.

5) 3 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
6) 3 Hour Construction: UL System C-AJ-2220; Hilti FS-ONE MAX Intumescent Firestop Sealant.
7) 3 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSC Collars.
8) 3 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSW Wrap Strips.
9) 3 Hour Construction: UL System C-AJ-2342; Hilti CP-E/S Firestop Wrap Strip.
10) 2 and 3 Hour Construction: UL System C-AJ-2843; HoldRite HydroFlame Pipe Collar.
11) 2 Hour Construction: UL System C-AJ-2167; Hilti FS-ONE MAX Intumescent Firestop Sealant.
12) 2 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
13) 2 Hour Construction: UL System C-AJ-2106; Specified Technologies Inc. SSW Wrap Strips.
14) 2 Hour Construction: UL System C-AJ-2282; Specified Technologies Inc. SSW Wrap Strips.
15) 2 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSC Collars.
16) 2 Hour Construction: UL System C-AJ-2297; Specified Technologies Inc. SSW Wrap Strips.
17) 2 Hour Construction: UL System C-AJ-2298; Specified Technologies Inc. LCC Intumescent Firestop Collars.
18) 2 Hour Construction: UL System C-AJ-2588; Specified Technologies Inc. RTC Range-Taking Collar.
19) 2 Hour Construction: UL System C-AJ-2772; Specified Technologies Inc. SSW Wrap Strips.
20) 2 Hour Construction: UL System C-BJ-2021; Hilti CP 643N Firestop Collar.

e. Electrical Cables Not In Conduit:
1) 3 Hour Construction: UL System C-AJ-3085; Specified Technologies Inc. LC Endothermic Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 3 Hour Construction: UL System C-AJ-3154; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
4) 3 Hour Construction: UL System C-AJ-3154; Specified Technologies Inc. SSP Firestop Putty.
5) 3 Hour Construction: UL System C-AJ-3208; Hilti CP 618 Firestop Putty Stick.
6) 3 Hour Construction: UL System C-AJ-3312; Specified Technologies Inc. FP Intumescent Firestop Plug.
7) 3 Hour Construction: UL System C-AJ-3360; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
8) 2 Hour Construction: UL System C-AJ-3213; Specified Technologies Inc. LCC Intumescent Firestop Collars.
9) 2 Hour Construction: UL System C-AJ-3213; Specified Technologies Inc. SSC Collars.
10) 2 Hour Construction: UL System W-J-3046; Specified Technologies Inc. SSP Firestop Putty.
11) 2 Hour Construction: UL System C-AJ-3154; Specified Technologies Inc. SSP Firestop Putty.
12) 2 Hour Construction: UL System C-AJ-3375; HoldRite HydroFlame 300 CG (Caulk Grade) Silicone Firestop Sealant.
13) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
14) 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit.
15) 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.

16) 2 Hour Construction: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
17) 2 Hour Construction: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.

f. Low Voltage Cables Not In Conduit:
1) 3 Hour Construction: UL System C-AJ-3231; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
2) 2 Hour Construction: UL System C-AJ-3283; Hilti CP653 Speed Sleeve.
3) 2 Hour Construction: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

g. Cable Trays with Electrical Cables:
1) 2 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.

h. Electrical Busways:
1) 3 Hour Construction: UL System C-AJ-6017; Hilti FS-ONE MAX Intumescent Firestop Sealant.

i. Insulated Pipes:
1) 3 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-5410; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
3) 3 Hour Construction: UL System C-AJ-5436; HoldRite HydroFlame 300 SL (Floors Only), or HoldRite HydroFlame 300 CG (Walls or Floors).
4) 2 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, CP 604 Self-Leveling Firestop Sealant or CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
5) 2 Hour Construction: UL System C-AJ-5087; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
6) 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX Intumescent Firestop Sealant.
7) 2 Hour Construction: UL System C-AJ-5138; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
8) 2 Hour Construction: UL System C-AJ-5313; Specified Technologies Inc. LC Endothermic Firestop Sealant.
9) 2 Hour Construction: UL System C-AJ-5433; HoldRite HydroFlame 300 CG (Caulk Grade).

j. HVAC Ducts, Uninsulated:
1) 3 Hour Construction: UL System C-AJ-7051; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 3 Hour Construction: UL System C-AJ-7204; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.
4) 2 Hour Construction: UL System C-AJ-7224; HoldRite HydroFlame 300 SL (Floors Only), or HoldRite HydroFlame 300 CG (Walls or Floors).
5) 2 Hour Construction: UL System C-AJ-7222; HoldRite HydroFlame 300 CG (Caulk Grade).

3. Penetrations Through Floors By:
a. Multiple Penetrations in Large Openings:
1) 3 Hour Construction: UL System F-A-1023; Hilti CP 680-P/M Cast-In Device.
2) 3 Hour Construction: UL System F-A-3052; HoldRite HydroFlame HFP-Px, HFP-PxB, HFP-Mx, or HFP-MxB Cast-In Device.
3) 3 Hour Construction: UL System F-A-8034; HoldRite HydroFlame HFP-P3, or HFP-P3B Cast-In Device.

4) 2 Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.

b. Uninsulated Metallic Pipe, Conduit, and Tubing:
   1) 3 Hour Construction: UL System F-A-1017; Hilti CP 680-P/M Cast-In Device.
   2) 3 Hour Construction: UL System F-A-1110; Specified Technologies Inc. CID Cast-In Device.
   3) 3 Hour Construction: UL System F-B-1038; HoldRite HydroFlame HFP-M/P8, HFP-M/P10, or HFP-M/P12 Cast-In Device.
   4) 2 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.
   5) 2 Hour Construction: UL System F-A-1110; Specified Technologies Inc. CID Cast-In Device.
   6) 2 Hour Construction: UL System F-A-1129; Specified Technologies Inc. Closet Flange Firestop Gasket.

c. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   1) 3 Hour Construction: UL System F-A-2054; Hilti CP 680-P Cast-In Device.
   2) 3 Hour Construction: UL System F-A-2066; Hilti CP 680-P Cast-In Device.
   3) 3 Hour Construction: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
   4) 3 Hour Construction: UL System F-A-2192; Specified Technologies Inc. CID Cast-In Device.
   5) 3 Hour Construction: UL System F-A-2246; Specified Technologies Inc. CID Cast-In Device.
   6) 3 Hour Construction: UL System F-B-1038; HoldRite HydroFlame HFP-P8, HFP-P10, or HFP-P12 Cast-In Device.
   7) 2 and 3 Hour Construction: UL System F-A-1133; HoldRite HydroFlame HFP-Px, HFP-PxB Cast-In Device.
   8) 2 Hour Construction: UL System F-A-2065; Hilti CP 680-P Cast-In Device.
   9) 2 Hour Construction: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
   10) 2 Hour Construction: UL System F-A-2053; Hilti CP 680-P Cast-In Device.
   11) 2 Hour Construction: UL System F-A-2216; Specified Technologies Inc. Closet Flange Firestop Gasket.
   12) 2 Hour Construction: UL System F-A-2246; Specified Technologies Inc. CID Cast-In Device.

d. Electrical Cables Not In Conduit:
   1) 3 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
   2) 3 Hour Construction: UL System F-A-3052; HoldRite HydroFlame HFP-Px, HFP-PxB, HFP-Mx, or HFP-MxB Cast-In Device.
   3) 2 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
   4) 2 Hour Construction: UL System F-A-3032; Specified Technologies Inc. Ready Split Sleeve.

e. Low Voltage Cables Not In Conduit:
   1) 3 Hour Construction: UL System F-A-3021; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   2) 3 Hour Construction: UL System F-A-3037; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   3) 3 Hour Construction: UL System F-A-3054; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   4) 2 Hour Construction: UL System F-A-3058; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.

f. Electrical Busways:
   1) 3 Hour Construction: UL System C-AJ-6017; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.
   2) 2 Hour Construction: UL System F-A-6002; Hilti CP 604 Self-Leveling Firestop Sealant.

g. Insulated Pipes:

1) 3 Hour Construction: UL System F-A-5016; Hilti CP 680-P Cast-In Device.
2) 3 Hour Construction: UL System F-A-5018; Hilti CP 680-P Cast-In Device.
3) 3 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID Cast-In Device.
4) 3 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID Cast-In Device.
5) 3 Hour Construction: UL System F-A-5013; HoldRite HydroFlame HFP-M/P8, HFP-M/P10, or HFP-M/P12 Cast-In Device.
6) 2 and 3 Hour Construction: UL System F-A-5043; HoldRite HydroFlame HFP-Px, or HFP-PxB Cast-In Device.
7) 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.
8) 2 Hour Construction: UL System F-A-5017; Hilti CP 680-P/M Cast-In Device.
9) 2 Hour Construction: UL System F-A-5041; Specified Technologies Inc. CID Cast-In Device.
10) 2 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID Cast-In Device.

4. Penetrations Through Walls By:
   a. Uninsulated Metallic Pipe, Conduit, and Tubing:
      1) 3 Hour Construction: UL System C-AJ-1700; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      2) 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      3) 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. Electrical Cables Not In Conduit:
      1) 4 Hour Construction: UL System W-J-3142; Specified Technologies Inc. Ready-Sleeve.
      2) 4 Hour Construction: UL System W-J-3157; Specified Technologies Inc. Ready Split Sleeve.
      3) 2 Hour Construction: UL System C-AJ-3357; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      4) 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      5) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
      6) 2 Hour Construction: UL System W-J-3090; Specified Technologies Inc. SSP Firestop Putty.
      7) 2 Hour Construction: UL System C-AJ-3357; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      8) 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      9) 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
      10) 2 Hour Construction: UL System W-J-3090; Specified Technologies Inc. SSP Firestop Putty.
      11) 2 Hour Construction: UL System W-J-3141; Specified Technologies Inc. Ready-Sleeve.
      12) 2 Hour Construction: UL System W-J-3156; Specified Technologies Inc. Ready Split Sleeve.
      13) 2 Hour Construction: UL System W-J-3182; Specified Technologies Inc. Ready Split Sleeve.
      14) 2 Hour Construction: UL System W-J-3182; Specified Technologies Inc. Ready-Sleeve.
   c. Low Voltage Cables Not In Conduit:
      1) 4 Hour Construction: UL System W-J-3195; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
      2) 2 Hour Construction: UL System W-J-3098; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.

3) 2 Hour Construction: UL System W-J-3130; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
4) 2 Hour Construction: UL System W-J-3138; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
5) 2 Hour Construction: UL System W-J-3158; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
6) 2 Hour Construction: UL System W-J-3180; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.

d. Insulated Pipes:
1) 2 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3) 2 Hour Construction: UL System C-AJ-5407; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4) 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
5) 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

e. HVAC Ducts, Uninsulated:
1) 3 Hour Construction: UL System C-AJ-7204; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
2) 2 Hour Construction: UL System W-J-7092; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
3) 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant, or CP 606 Flexible Firestop Sealant.

f. HVAC Ducts, Insulated:
1) 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

E. FIRESTOPPING PENETRATIONS THROUGH FRAMED FLOORS

1. Metallic Pipe, Conduit, and Tubing Penetrations in Framed Floors:
a. 1 and 2 Hour Construction: UL System F-C-1177; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
b. 1 Hour Construction: UL System F-C-1053; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
c. 1 Hour Construction: UL System F-C-1162; Specified Technologies Inc. Closet Flange Firestop Gasket.

2. Non-Metallic Pipe, Conduit or Tubing in Framed Floors:
a. 2 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
b. 2 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC collars.
c. 2 Hour Construction: UL System F-C-2348; Specified Technologies Inc. RTC Range-Taking Collar.
d. 2 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.
e. 1 and 2 Hour Construction: UL System F-C-2473; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
f. 1 Hour Construction: UL System F-C-2487; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
g. 1 Hour Construction: UL System F-C-2014; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
h. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.

i. 1 Hour Construction: UL System F-C-2020; Specified Technologies Inc. SSC Collars.
j. 1 Hour Construction: UL System F-C-2348; Specified Technologies Inc. RTC Range-Taking Collar.
k. 1 Hour Construction: UL System F-C-2402; Specified Technologies Inc. Closet Flange Firestop Gasket.

3. Electrical Cable in Framed Floors:
   a. 1 Hour Construction: UL System F-C-3010; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
   b. 1 and 2 Hour Construction: UL System F-C-3121; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
4. Insulated Pipe in Framed Floors:
   a. 2 Hour Construction: UL System F-C-5090; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   b. 1 Hour Construction: UL System F-C-5043; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
5. FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS
   a. Blank Openings:
      1) 4 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      2) 3 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      3) 2 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      4) 2 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.
      5) 2 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
      6) 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
      7) 1 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
      8) 1 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.
      9) 1 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
      10) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   b. Penetrations By:
      (a) 2 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      (b) 2 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
      (c) 2 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
      (d) 2 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
      (e) 2 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      (f) 2 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
      (g) 2 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      (h) 1 and 2 Hour Construction: UL System W-L-1568; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      (i) 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      (j) 1 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
      (k) 1 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.

(l) 1 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop pillows.
(m) 1 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(n) 1 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
(o) 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2) Uninsulated Metallic Pipe, Conduit, and Tubing:
(a) 3 and 4 Hour Construction: UL System W-L-1560; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-1033; Specified Technologies Inc. SIL Silicone Sealant.
(c) 2 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(d) 2 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(g) 2 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(h) 2 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(i) 2 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
(j) 2 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
(k) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
(l) 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(m) 1 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(n) 1 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(o) 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(p) 1 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(q) 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(r) 1 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(s) 1 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
(t) 1 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.

3) Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
(a) 4 Hour Construction: UL System W-L-2704; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
(c) 2 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.

(d) 2 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
(e) 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
(g) 2 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(h) 2 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
(i) 2 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC Range-Taking Collar.
(j) 1 and 2 Hour Construction: UL System W-L-2710; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(k) 1 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
(l) 1 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.
(m) 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
(n) 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(o) 1 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
(p) 1 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(q) 1 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW Wrap Strips.
(r) 1 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC Range-Taking Collar.

4) Electrical Cables Not In Conduit:
(a) 4 Hour Construction: UL System W-L-3276; Specified Technologies Inc. Ready-Sleeve.
(b) 4 Hour Construction: UL System W-L-3304; Specified Technologies Inc. Ready Split Sleeve.
(c) 3 Hour Construction: UL System W-L-3276; Specified Technologies Inc. Ready-Sleeve.
(d) 3 Hour Construction: UL System W-L-3304; Specified Technologies Inc. Ready Split Sleeve.
(e) 2 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
(f) 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
(g) 2 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(h) 2 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(i) 2 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
(j) 2 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(k) 2 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
(l) 2 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.

(m) 2 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.
(n) 2 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
(o) 2 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
(p) 2 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
(q) 2 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.
(r) 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit.
(s) 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.
(t) 2 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.
(u) 1 and 2 Hour Construction: UL System W-L-3453; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
(v) 1 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
(w) 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
(x) 1 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(y) 1 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(z) 1 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
(aa) 1 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(bb) 1 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
(cc) 1 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(dd) 1 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.
(ee) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
(ff) 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
(gg) 1 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
(hh) 1 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.
(ii) 1 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.

5) Low Voltage Cable Not In Conduit:
(a) 4 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(b) 3 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(c) 2 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(d) 2 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.

(e) 2 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(f) 2 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(g) 2 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(h) 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
(i) 2 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.
(j) 2 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
(k) 2 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(l) 2 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(m) 2 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.
(n) 2 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
(o) 2 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(p) 2 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
(q) 2 Hour Construction: UL System W-L-3395; Hilti CP653 Speed Sleeve.
(r) 1 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(s) 1 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(t) 1 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(u) 1 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(v) 1 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(w) 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
(x) 1 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.
(y) 1 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
(z) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
(aa) 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
(bb) 1 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.
(cc) 1 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
(dd) 1 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
(ee) 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

6) Cable Trays with Electrical Cables:

(a) 2 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(b) 2 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
(c) 2 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(d) 1 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
(e) 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
(f) 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.

7) Insulated Pipes:
(a) 2 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(c) 2 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
(d) 2 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(e) 2 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(f) 2 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(g) 1 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
(h) 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(i) 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
(j) 1 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
(k) 1 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
(l) 1 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (For Wood Frame Construction).
(m) 1 and 2 Hour Construction: UL System W-L-5357; HoldRite HydroFlame 200 Intumescent Firestop Sealant.

8) HVAC Ducts, Insulated:
(a) 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
(b) 2 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(c) 2 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(d) 1 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(e) 1 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
(f) 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. Install labeling required by code.

E. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. For continuous penetrations, install labels at 10 feet on center.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

C. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

SECTION 07 91 00
PREFORMED JOINT SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-compressed foam seals at exterior expansion joints.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.

C. Color Cards: For color selection.

D. Volatile Organic Content (VOC) Documentation: For adhesives and primers, submit VOC content and emissions documentation as specified in Section 01 61 16.

1.03 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pre-compressed Foam Seals:

1. Balco, Inc; www.balcousa.com.
2. Manufacturers with equivilant products are acceptable.

2.02 PRE-COMPRESSED FOAM SEALS

A. Pre-compressed Foam Seal: Comprised of urethane, modified-acrylic impregnated, open-cell polyurethane, or closed-cell neoprene foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.

1. Color: As selected from manufacturers standard colors.
2. Size as required to provide weathertight seal when installed.
3. Calculate size according to manufacturer's recommendations.
4. Measure size of existing joints before selecting seal width.
5. Applications:
   a. Exterior wall expansion joints.
6. Manufacturer/Product:
   a. Balco, Inc; Wall Compression Seals (BCSW)

B. Pre-compressed Foam Seal, Fire-Retardant Impregnated: Comprised of waterproof silicone faces on each side of fire-retardant impregnated foam sealant.

1. Color: As selected from manufacturers standard colors.
2. Size as required to provide water-tight seal when installed.
3. Calculate size according to manufacturer's recommendations.
4. Measure size of existing joints before selecting seal width.
5. Fire-Rating: As indicated on drawings, comply with UL 2079.
6. Applications:
   a. Exterior wall expansion joints.
7. Manufacturer/Product:
   a. Balco, Inc; Wall Compression Seals, FRBCSW

2.03 ACCESSORIES

A. Adhesive: As recommended by seal manufacturer.

B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.

C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.

D. Primer: Type recommended by seal manufacturer to suit application; non-staining.

E. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive this work.

B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Precompressed Foam Seals:

1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
3. Remove loose materials and foreign matter that could impair adhesion of sealant.
4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect joints from damage until adhesives have properly cured.

END OF SECTION 07 91 00

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-sag gunnable joint sealants.
   1. Exterior applications
      a. Joints in masonry, including architectural precast.
      b. Joints in precast concrete wall panels.
      c. Joints around hollow metal.
      d. Miscellaneous joints where “sealant” or “caulk/caulking” is indicated on drawings.
      e. Joints around mechanical, electrical and architectural penetrations of exterior masonry skin.
      f. Installation of sealant on masonry quality control panel for color match and adhesion verification by means of an adhesion test.
      g. Removal and replacement of existing sealants.
   2. Interior applications
      a. Note: Sealant on materials to be painted will be installed after painting is completed and shall match paint color. A “sacrificial” backer rod shall be installed prior to painting to protect joints from paint over spray. This backer rod may be pushed into the joint or removed prior to installation of final backer rod and sealant.
      b. Interior joints in masonry.
      c. Interior joints in pre-cast concrete wall panels.
      d. Interior joints around hollow metal, including joint between hollow metal and hard surface flooring.
      e. Joints in slabs and at edges where painted, exposed or sealed concrete is shown on Drawings.
      f. Sealant at resilient flooring wall joint where vinyl base is not scheduled.
      g. Miscellaneous joints where “sealants” or “caulk/caulking” is indicated on Drawings.

B. Self-leveling pourable joint sealants.
C. Security applications.
D. Joint backings and accessories.
E. Owner-provided field quality control.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, which includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates product should not be used on.
C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
D. Samples for Verification: Where custom sealant color is specified, submit at least two physical samples for verification of each color to match adjacent materials of each required sealant.
E. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation; see Section 01 61 16.
F. Installation Plan: Submit at least four weeks prior to start of installation.
G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
H. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
I. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
J. Installation Log: Submit filled out log for each length or instance of sealant installed.
K. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

C. Installation Plan: Include schedule of sealed joints, including the following.

1. Installation Log Form: Include the following data fields, with known information filled out.
    a. Date of installation.
    b. Name of installer.
    c. Actual joint width; provide space to indicate maximum and minimum width.
    d. Actual joint depth to face of backing material at centerline of joint.
    e. Air temperature.

D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.

1. Identification of testing agency.
2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    a. Test date.
    b. Date of test.
    c. Copy of test method documents.
    d. Age of sealant upon date of testing.
    e. Test results, modeled after the sample form in the test method document.
    f. Indicate use of photographic record of test.

E. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.

F. Field Quality Control Plan:

1. Visual inspection of entire length of sealant joints.
2. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
    a. For each different sealant and substrate combination, allow for one test every 100 feet (30 meters) in the first 1000 linear feet (305 linear meters), and one test per 1000 linear feet (305 meters) thereafter, or once per floor on each elevation.
    b. If any failures occur in the first 1000 linear feet (305 linear meters), continue testing at frequency of one test per 500 linear feet (152 linear meters) at no extra cost to Owner.
3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

G. Field Adhesion Test Procedures:

1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
7. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

H. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
   1. Sample: At least 18 inch (457 mm) long.
   2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch (25 mm) by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
   3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
   4. Record results on Field Quality Control Log.
   5. Repair failed portions of joints.

I. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Non-Sag Sealants:
   1. Permits application in joints on vertical surfaces without sagging or slumping.
      a. BASF: www.master-builders-solutions.com.
      b. Pecora Corporation: www.pecora.com.
      c. SIKA: www.usa.sika.com.
      d. TREMCO: www.tremcosealants.com.
      e. Dow; www.dow.com.
      f. GE; www.siliconeforbuilding.com.

B. Self-Leveling Sealants:
   1. SelPourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
      a. BASF: www.master-builders-solutions.com.
      b. Pecora Corporation: www.pecora.com.
      c. SIKA: www.usa.sika.com.
      d. TREMCO: www.tremcosealants.com

C. Security Sealants:

D. One or two-component, nonsag elastomeric sealant with a shoe hardness of 50 +/- 5.
   1. BASF: www.master-builders-solutions.com.
   2. Pecora Corporation: www.pecora.com.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.

b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
c. Other joints indicated below and as shown on drawings.

3. Do not seal the following types of joints.
   a. Intentional weep holes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

2.03 JOINT SEALANTS - SUSTAINABLE REQUIREMENTS

A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 61 16.

B. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NON-SAG JOINT SEALANTS

A. Exterior Use: Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion.
   1. Movement Capability: +/- 25%, minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   5. Custom Colors: Match adjacent finished surfaces.
   6. Cure Type: Single-component, neutral moisture curing.
   7. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).
   8. Products:
      a. Dow; DOWSIL 790
      b. GE Silicone; SCS2700 LM
      c. Pecora Corporation; 890 or 890 FTS
      d. SIKA; Sikalsil WS-290 FPS
      e. Tremco; Spectrum 1

B. Exterior Use: Silyl-Terminated Polyether (STPE): ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.

C. Interior Use: Silyl-Terminated Polyether (STPE): ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 12-1/2 percent, minimum
   2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
   3. Custom Colors: Match adjacent finished surfaces.
   4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   5. Products:
      a. BASF; MasterSeal NP 150/Np100
      b. Pecora Corporation; DynaFlex SC (Security Sealant)
      c. SIKA; SIKAFLEX 2-C
      d. Tremco; Dymonic FC

D. Interior Use: Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Custom Colors: Match adjacent finished surfaces.
   4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   5. Products:
      a. BASF; MasterSeal: NP2

b. Pecora Corporation; DynaTrol II
c. SIKA; SIKAFLEX 2-C
d. Tremco; DYMERIC 240/240FC

2.05 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade M; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Tensile Strength: 150 psi (1.34 MPa) in accordance with ASTM D412.
5. Products:
a. Pecora Corporation; DynaTrol II-SG (Slope Grade)
b. SIKA; SIKAFLEX 2c SL
c. BASF; MasterSeal SL2
d. Tremco; THC/900/901

2.06 SECURITY SEALANTS

A. Vertical Joint Sealant: One-component, aliphatic, nonsag, elastomeric, polyurethane security sealant with a Shore A hardness of 50±5 conforming to ASTM C 920, Type S, Grade NS, Class 25. Maximum VOC 118 g/L.
1. Manufacturers/product:
a. BASF, MasterSeal CR 195
b. Pecora, DynaFlex

B. Horizontal Joint Sealant: Two-part flexible epoxy joint fillers with a Shore A hardness of 90 and maximum VOC of 3 g/L.
1. Manufacturers/product:
a. BASF, MasterSeal CR 190
b. Pecora, Dyna-Poxy EP 1200

2.07 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specified sealant, and recommended by backing and sealant manufacturers for specific application.
1. Joints not subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane
2. Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
3. Open Cell: 40 to 50 percent larger in diameter than joint width.
4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Pre-installation Adhesion Testing: Install a sample for each test location indicated in the test plan.
1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.
3. Record each test on Preinstallation Adhesion Test Log as indicated.
4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform acoustical sealant application work in accordance with ASTM C919.
C. Install bond breaker backing tape where backer rod cannot be used.
D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
F. Non-Sag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
G. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 EXISTING WORK

A. Mechanically remove existing sealants.
B. Clean joint surfaces of residual sealant and other contaminates capable of affecting sealant bond to joint surface by mechanical means.
C. Allow joint surfaces to dry before installing new sealant.

3.05 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
B. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet (300 linear m), notify Architect immediately.
C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
D. Repair destructive test location damage immediately after evaluation and recording of results.

3.06 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e., at low temperature in the thermal cycle. Report failures immediately and repair.

END OF SECTION 07 92 00

SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior floor covers for carpet, resilient tile and other flooring materials.
B. Interior fire rated covers for carpet, resilient tile and other flooring materials.
C. Interior wall covers.
D. Interior fire rated wall covers.
E. Interior expansion joints for ACT, gypsum board and other ceiling materials.
F. Exterior expansion joint covers for exterior walls.
G. Exterior pre-compressed expansion joint system.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
   1. BALCO. www.balcousa.com
   2. Inpro: www.inprocorp.com.
   3. Nystrom, Inc: www.nystrom.com.
   4. Equivalent products by other manufacturers are acceptable.

2.02 INTERIOR FLOOR EXPANSION JOINT COVERS

A. Interior Joints Subject to Thermal Movement:
   1. Carpet
      a. Floor to floor assembly, 50% movement up to 1"
         1) Balco 6FC-1M
         2) InPro 300-A01-025
         3) Nystrom EJ-NBR-100
      b. Floor to wall assembly, 50% movement up to 1"
         1) Balco 6FVC-1M.
         2) InPro 300-A02-025
         3) Nystrom EJ-NBR-100W
      c. Floor to floor assembly, 50% movement up to 2"
         1) Balco 6FC-2M
         2) InPro 300-A01-050
         3) Nystrom EJ-NBR-200
      d. Floor to wall assembly, 50% movement up to 2"
         1) Balco 6FVC-2M.
         2) Inpro 300-A02-050
         3) Nystrom EJ-NBR-200W
      e. 2 hour rated floor to floor assembly, 50% movement to 1"
         1) Balco 2H6FC-1 / MPF2H
         2) Inpro 300-A01-025 / Fireline 520
         3) Nystrom EJ-2HNBR-100 / EJ-FLF
      f. 2 hour rated floor to wall assembly, 50% movement to 1"
         1) Balco 2H6FVC-1 / MPFV2H

2) Inpro 300-A01-025 / Fireline 520
3) Nystrom EJ-2HNBR-100W / EJ-FLF

2. Resilient Tile
   a. Floor to floor assembly, 50% movement to 1" and 1/8" recess for tile
      1) Balco 6FTP-1M
      2) InPro 304-A01-025
      3) Nystrom EJ-NBR-100
   b. Floor to wall assembly, 50% movement up to 1" and 1/8" recess for tile
      1) Balco 6FVTP-1M.
      2) Inpro 304-A02-025
      3) Nystrom EJ-NBRw-100
   c. Floor to floor assembly, 50% movement to 2" and 1/8" recess for tile
      1) Balco 6FTP-2M
      2) Inpro 304-A01-025
      3) Nystrom EJ-NBR-200
   d. Floor to wall assembly, 50% movement up to 2" and 1/8" recess for tile
      1) Balco 6FVTP-2M.
      2) Inpro 304-A02-025
      3) Nystrom EJ-NBRw-200
   e. 2 hour rated floor to floor assembly, 50% movement up to 1"
      1) Balco 2H6FTP-1/ MPF2H
      2) Inpro 304-A01-025 / Fireline 520
      3) Nystrom EJ-2HNBR-100 / EJ-FLF
   f. 2 hour rated floor to wall assembly, 50% movement up to 1"
      1) Balco 2H6FVTP-1 / MPFV2H
      2) InPro 304-A02-025 / Fireline 520
      3) Nystrom EJ-2HNBRw-100 / EJ-FLF
3. Other floor finishes
   a. Floor to floor assembly, 50% movement up to 1"
      1) Balco 6FS-1M
      2) InPro 300-A01-025
      3) Nystrom EJ-NBF-100
   b. Floor to wall assembly, 50% movement up to 1"
      1) Balco 6FVS-1M.
      2) InPro 300-A02-025
      3) Nystrom EJ-NBFw-100
   c. Floor to floor assembly, 50% movement up to 2"
      1) Balco 6FS-2M
      2) InPro 300-A01-050
      3) Nystrom EJ-NBF-200
   d. Floor to wall assembly, 50% movement up to 2"
      1) Balco #6FVS-2M.
      2) InPro 300-A02-050
      3) Nystrom #EJ-NBFw-200
   e. 2 hour rated floor to floor assembly, 50% movement up to 1"
      1) Balco 2H6FS-1 / MPF2H
      2) InPro 300-A01-025 / Fireline 520
      3) Nystrom EJ-2HNBF-100 / EJ-FLF
   f. 2 hour rated floor to wall assembly, 50% movement up to 1"
      1) Balco 2H6FVS-1 / MPFV2H
      2) Inpro 300-A02-025 / Fireline 520
      3) Nystrom EJ-2HNBFw-100W / EJ-FLF

2.03 INTERIOR WALL EXPANSION JOINT COVERS

A. Interior Joints Subject to Thermal Movement:
   1. Wall to wall assembly, 50% movement up to 1"
      a. Balco 6TW-1
      b. InPro 300-A07-025
      c. Nystrom EJ-NBW-100
   2. Wall to corner assembly, 50% movement up to 1"
      a. Balco 6TWC-1.
      b. InPro 300-A09-025
      c. Nystrom EJ-NBWw-100
   3. 2 hour rated wall to wall assembly, 50% movement up to 1"
      a. Balco 2H6TW-1 / MW2H
      b. InPro 300-A07-025 / Fireline 520
      c. Nystrom EJ-2HNBW-100 / EJ-FLW
   4. 2 hour rated wall to corner assembly, 50% movement up to 1"
      a. Balco 2H6TWC-1 / MCW2H
      b. InPro 300-A09-025 / Fireline 520
      c. Nystrom EJ-2HNBWw-100 / EJ-FLW
   5. Wall to wall assembly, 50% movement up to 2"
      a. Balco 6TW-2
      b. InPro 300-A07-050
      c. Nystrom EJ-NBW-200
   6. Wall to corner assembly, 50% movement up to 2"
      a. Balco 6TWC-2.
      b. InPro 300-A09-050
      c. Nystrom EJ-NBWw-200
   7. 2 hour rated wall to wall assembly, 50% movement up to 2"
      a. Balco 2H6TW-2 / MW2H
      b. InPro 300-A07-050 / Fireline 520
      c. Nystrom EJ-2HNBW-200 / EJ-FLW
   8. 2 hour rated wall to corner assembly, 50% movement up to 2"
      a. Balco 2H6TWC-2 / MCW2H
      b. InPro 300-A09-050 / Fireline 520
      c. Nystrom EJ-2HNBWw-200 / EJ-FLW

2.04 INTERIOR CEILING EXPANSION JOINT COVERS

A. Acoustical Lay-in Ceilings.
   1. Ceiling to ceiling assembly, 50% movement up to 2"
      a. Color: White
      b. Balco ACWW-2
      c. InPro 115-A24-050
      d. Nystrom EJ-LCE-200
   2. Ceiling to wall assembly, 50% movement up to 2"
      a. Color: White
      b. Balco ACWWL-2.
      c. InPro 115-A18-050
      d. Nysrom EJ-LCEw-200

B. Gypsum Board Ceilings.
   1. Ceiling to ceiling assembly, 25% movement with 1" joint
      a. Color: White
      b. Balco 75FWG-1
      c. InPro 113-A07-025
      d. Nystrom EJ-LCW-100
   2. Ceiling to corner assembly, 25% movement with 1" joint
      a. Color: White

b. Balco 75FWGC-1
c. InPro 113-A09-025
d. Nystrom EJ-LCWw-100

3. Ceiling to ceiling assembly, 25% movement with 2" joint
   a. Color: White
   b. Balco 75FWG-2
   c. InPro 113-A07-050
   d. Nystrom EJ-LCW-200
4. Ceiling to corner assembly, 25% movement with 2" joint
   a. Color: White
   b. Balco 75FWGC-2.
   c. InPro 113-A09-050
   d. Nystrom EJ-LCWw-200

C. Other ceiling materials.
1. Ceiling to ceiling assembly, 25% movement with 1" joint
   a. Balco 75FWPE-1
   b. InPro 104-A07-025
   c. Nystrom EJ-LCW-100
2. Ceiling to wall assembly, 25% movement with 1" joint
   a. Balco 75FWVPE-1
   b. InPro 104-A09-025
   c. Nystrom EJ-LCWw-100
3. Ceiling to ceiling assembly, 25% movement with 2" joint
   a. Balco 75FWPE-2
   b. InPro 104-A07-050
   c. Nystrom EJ-LCW-200
4. Ceiling to wall assembly, 25% movement with 2" joint
   a. Balco 75FWVPE-2.
   b. InPro 104-A09-050
   c. Nystrom EJ-LCWw-200

2.05 EXTERIOR EXPANSION JOINTS

A. Exterior Wall Joints with Covers, Subject to Thermal Movement:
1. Wall to wall assembly, 100% movement up to 2"
   a. 45 mil EPDM water barrier.
   b. 100% movement up to 2”.
   c. Mastic to provide a water tight seal.
      1) Balco 9W-2
      2) InPro 651-A07-100
      3) Nystrom EJ-RJX-200
2. Wall corner assembly, 100% movement up to 2"
   a. 45 mil EPDM water barrier.
   b. 100% movement up to 2”.
   c. Mastic to provide a water tight seal.
      1) Balco 9WC-2
      2) InPro 651-A09-100
      3) Nystrom EJ-RJXqw-200

B. Pre-compressed Exterior Expansion Joint Seals:
1. Open cell hydrophic polymer impregnated polyurethane foam with integral colorized silicone facing.
   a. Color as selected by Architect from manufacturing standard colors.
2. 50% movement.
3. Size as recommended by manufacturer for wall gap.
4. Field applied silicone: 100% silicone, color to match silicone facing.
   a. BALCO BCSW

b. Nystrom SES

2.06 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.

C. Covers In Fire Rated Assemblies: Provide cover assembly and all components having fire rating equivalent to that of assembly into which it is installed.

2.07 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
   1. Exposed Finish Outdoors: Natural anodized.
   2. Exposed Finish at Floors: Mill finish or natural anodized.
   3. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Resilient Seals:
   1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
      a. Colors as selected from manufacturers standard line.
   2. For Pedestrian Traffic Applications: EPDM rubber, Neoprene, or Santoprene; no PVC; Shore A hardness of 40 to 50 Durometer.
      a. Colors as selected from manufacturer's standard.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.

E. Threaded Fasteners: Aluminum.

F. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

END OF SECTION 07 95 13

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

TURN OFF DETENTION HM
TURN OFF COMMERCIAL SECURITY HM (POLICE STATIONS, ETC.)
TURN OFF STORM SHELTER HM
TURN OFF STAINLESS STEEL HM (POOLS/OTHER)
TURN OFF RENOVATION NOTES
TURN OFF HEATHCARE/SENIOR LIVING ITEMS
TURN OFF LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Hollow metal frames for wood doors.
C. Fire-rated hollow metal doors and frames as scheduled and/or noted on the Code Plans.
D. Thermally insulated hollow metal doors with field insulated frames.
E. Commercial security hollow metal doors noted on Door/Opening Schedule as SHM.
F. Detention hollow metal doors and frames noted on Door/Opening Schedule as DHM.
G. Stainless-steel hollow metal doors and frames.
H. Tornado-resistant hollow metal doors and frames.
I. Hollow metal borrowed lites glazing frames.
J. DE Series double egress HM frames for doors swings over 90°.
K. Provide equal rabbit door frames.
L. Modifications to existing frames as noted on drawings or for hardware changes.
M. Louvers in HM doors.
N. Accessories, including glazing, louvers, and matching panels.

1.02 DETENTION HM COORDINATION/PRE-INSTALLATION CONFERENCE

A. A Coordination/Pre-installation conference shall be held prior to production of Detention Hollow Metal Doors and Frames. Conference shall include the General Contrator or Construction Manager, Architect, Installing Contractors for Detention HM, Glazing and Hardware, Detention HM and Hardware Supplier and/or Manufacturer, Contractors responsible for wiring of electric hardware. Agenda for the meeting shall include, but not limited to the following:
    1. Review of submittals.
    2. Coordination of items to maintain Detention Security of openings.
    3. Review of hardware requiring electrical raceways in doors and frames and wiring of each.
    4. Review of installation requirements.
    5. Contractor Affidavit requirements after installation.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
C. Shop Drawings:
    1. Elevations of each door design.
    2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
    3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
    4. Locations of reinforcement and preparations for hardware.
    5. Details of each different wall opening condition.
    6. Details of anchorages, joints, field splices, and connections.
    7. Details of accessories.
    8. Details of molding, removable stops, and glazing.
    9. Detail of conduit and preparations for power, signal, and control systems.
    10. Rating of doors and frames as noted on door/opening schedule and/or Code Plan.
D. Detention HM Doors and Frames: Provide additional information in addition to those required above.
    1. Independent testing reports on door impact and racking tests.

2. Manufacturers qualification statement, including a Notorized Affidavit from a Corporate Officer of the Detention HM Manufacturer stating that all detention hollow metal is constructed to the requirements of the specification and testing agency's labels requirements.
3. Installer's Notorized Affidavit from a Corporate Officer of the Installing Contractor to be provided at the completion of the project stating that all Detention HM Doors and Frames, Assocoated Glazing, and Detention Hardware installation has been coordinated with and installed according to the manufacturer's and testing agency's label requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: https://steeldoor.org/sdi-certified.
B. Obtain hardware templates from hardware supplier (Section 08 71 00) and obtain necessary hardware for factory application.
C. Where noted on Door Schedule, provide nationally recognized testing agency label of proper classification. Label requirements take precedence over conflicting details. Advise the Architect of any conflict before fabricating work on that item is started.
D. Provide Tornado door assemblies complying with ICC500-"Standard for the Design and Construction of Storm Shelters".
E. Manufacturer Qualifications: Company specializing in manufacturing detention products specified in this section with not less than 10 years experience and employing production welders holding a welders certificate in accordance with AWS QC-3, D1.3. Provide documentation if requested by the Architect.
    1. Provide independently tested door products per the following:
        a. Door Static Load: Under static load of 14,000 lbs. (6577.09 kg) at quarter points, maximum permitted deflection 0.1 inch (0.254 mm) after release of pressure without any failure of door panel.
        b. Door Rack: Under a concentrated load of 7,500 lbs. (3401.94 kg) on one unsupported corner, maximum deflection shall not exceed 3.55 inches (90.17 mm) with no failure of construction or welds.
F. Maintain at project site copies of reference standards relating to installation of products specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
C. Storage at jobsite:
    1. Store frames on pallets, under waterproof cover.
    2. Do not deliver doors until they can be stored inside.
        a. Store doors under cover in a dry area with doors set upright with ¼ inch spacers between doors. Keep doors at least 4" above floors.
    3. Materials that are rusted prior to installation may be rejected.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
    1. Steelcraft, an Allegion brand: www.allegion.com.
    2. Equivalent products by other manufacturer's are acceptable.
B. Commercial Security Hollow Metal Doors:
    1. Steelcraft, an Allegion brand: www.allegion.com.
    2. Equivalent products by other manufacturer's are acceptable.
C. Detention Security Hollow Metal Doors and Frames:
    1. Basis of Design: Habersham Metal Products Company: Security Hollow Metal; www.habershammetal.com.
    2. Equivalent products by other manufacturers are acceptable.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Top and Bottom Closures: Flush end 16 gauge full width closure channel, with top and door faces aligned.
    a. Provide an additional flush closing channel at top edge for exterior doors
    b. Provide openings to bottom closure of exterior door to permit escape of moisture.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Typical Door Face Sheets: Embossed: Steelcraft GRAINTECH "T" Series
    a. Color: Custom to match wood door finish.
7. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
8. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
    a. All doors to have minimum 16-gauge lock reinforcement and either continuous 14-gauge hinge rail or minimum 8-gauge plate hinge reinforcement.
9. Zinc Coating for Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
10. Frames for Exterior Masonry/Concrete and in Precast Concrete Wall Panels: Prepped for countersunk bolted in anchors.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Doors to have minimum 16-gauge lock reinforcement and either continuous 14-gauge hinge rail or minimum 8-gauge plate hinge reinforcement.

C. Clearances: Edge clearances shall be provided as follows:
1. Between doors and frame, at head and jambs - 1/8"
2. At door sills:
    a. where no threshold is used - 5/8" maximum to finish floor surface.
    b. where polymer threshold at toilet room doors is used - 1/4" maximum between door and threshold.
    c. where no threshold is used at toilet stall or single stall toilet rooms - 1/4" maximum to finish floor surface.
    d. where threshold is used - 1/4" maximum between door and threshold.
    e. where required for hardware operation - as recommended by hardware manufacturer.
3. Between meeting edges of pairs of doors - 1/8"

D. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

c. All faced edge seams to be continuously wire welded, finished smooth.
d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
   a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
4. Door Thermal Resistance: R-Value of 9.9.
5. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

E. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 Full Flush
   d. All faced edge seams to be continuously wire welded or interlocking edge. Finished smooth.
   e. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

F. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
   c. All faced edge seams to be continuously wire welded, finished smooth.
   d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Fire Rating: As indicated on Door Schedule and/or the Code Plan tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   a. Attach fire rating label to each fire rated unit.
5. Smoke and Draft Control Doors: Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
   a. Maximum Air Leakage: 3.0 cfm/sq ft (0.02 cu m/sec/sq m) of door opening at 0.10 inch w.g. (24.9 Pa) pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
   b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
   c. Label: Include the "S" label on fire-rating label of door.
6. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
7. Exterior Door Core Material: Mineral board.
8. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

G. Detention Security Doors; Interior and Exterior:
1. Based on NAAMM HMMA Custom Guidelines:
   a. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   b. Interior Door Face Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
   c. Exterior Door Face Metal Thickness: 12 gauge, 0.093 inch (2.3 mm), minimum.
      1) Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.
2. Detention Security Facility Swinging Door Assemblies: Comply with Grade 3 security characteristics, in accordance with NAAMM HMMA 863 and ASTM F1450 requirements.

3. Bullet Resistance, UL 752, Threat Level Rating:
    a. Level 1.
    b. Level 2.
    c. Level 3.
    d. Level 4.
    e. Level 5.
    f. Level 6.
    g. Level 7.
    h. Level 8.
4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
5. Exterior Door Core Material: Polystyrene.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
6. Door Thickness: As required to meet requirements indicated.
7. Door Face Sheets: Flush, continuously welded, ground, filled and finshed flush.
8. Door Finish: Factory primed and field finished.
9. Door Reinforcement:
    a. Interior reinforced with continuous rolled or formed steel channel, 18 gauge, 0.042 inch (1.0 mm) minimum metal thickness at 4 inch (102 mm) on center, welded at 3 inch (76 mm) on center maximum.
    b. Vertical Edge, Top and Bottom Reinforcement: Continuous full height steel channel, 10 gauge, 0.123 inch (3.1 mm) minimum metal thickness, welded at 3 inch (76 mm) on center maximum, and compatible with 4-1/2 inch (114 mm) full mortise template and continuous geared hinges.
    c. Hardware Reinforcement, welded in place:
        1) Full mortise hinges and pivots, as well as strike reinforcements: 7 gauge, 0.167 inch (4.2mm).
        2) Surface applied maximum security hinges: 4 gauge, 0.214 inch (5.4 mm).
        3) Slide device hanger attachment: Per device manufacturers recommendations.
        4) Lock fronts, concealed holders, or surface mounted closers and internal reinforcements for all other surface applied hardware: 12 gauge, 0.093 inch (2.3 mm).
        5) Mechanical pocket type locks: 10 gauge, 0.123 inch (3.1 mm) around entire perimeter of box.
10. Electrically Operated Hardware: Furnish hardware enclosures and junction boxes interconnected with UL approved 1/2 inch (13 mm) conduit elbows and connectors.
    a. Access plates to be same gauge as door face and fastened with torx tamper resistant screws.
11. Glazing stops:
    a. Fixed: 12 gauge, 0.093 inch (2.3 mm) and spot welded to both faces at 3 inch (76 mm) on center.
    b. Removable: 10 gauge, 0.123 inch (3.1 mm) steel angle or when glazing thickness dictates, 12 gauge, 0.093 inch (2.3 mm) offset surface mounted steel glazing stop. fastened with tamper resistant screws.
        1) Fastened with tamper resistant screws.
12. Louvers: Welded inverted "V" type construction of 12 gauge, 0.093 (2.3 mm) steel.
    a. Provide 3/4 inch (19 mm) vertical steel bar on louvers over 18 inch (457 mm) in width.
    b. Interior of the louver between the rectangular hole patterns baffled with 14 gauge, 0.067 inch (1.7 mm) steel sections.
13. Food Pass Openings: Flush opening with interior steel channels of 12 gauge, 0.093 inch (2.3 mm) thickness and corner seams continuously welded.
    a. Shutter constructed of two 10 gauge, 0.123 inch (31 mm) steel plates spot welded together.
        1) Shipped loose for field installation.

H. Commercial Security Doors; Interior and Exterior:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 4 - Maximum-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. All faced edge seams to be continuously wire welded, finished smooth.
d. Interior Door Face Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
e. Exterior Door Face Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
1) Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Door Core Material: Steel stiffened with minimum 22 gauge (0.644 mm) vertical stiffiners at 6 inches (152.4 mm) o.c. and welded no more than 5 inches (127 mm) along thier length. 16 gauge (1.291 mm) perimeter steel channels.
3. Hardware reinforcement:
a. 7 gauge (3.664 mm) steel plate welded in place and tapped as appropriate for hardware.
1) Closer reinforcement: 12 gauge steel plate (2.052 mm).
4. Interior Door Core Material: Fiberglass batts.
5. Exterior Door Core Material: Polyurethane.
a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
6. Door Thickness: 1-3/4 inch (44.5 mm).
7. Door Face Sheets: Flush.
8. Door Finish: Factory primed and field finished.
9. Metal Vision Frame: 10 gauge (2.588 mm) cold rolled steel. Countersunk mounting holes.
a. Security screw fasteners.

I. Stainless-Steel Doors and Frames:
1. Based on NAAMM HMMA Custom Guidelines: Comply with guidelines of NAAMM HMMA 866 for stainless-steel hollow metal doors.
a. Physical Endurance - Level A (1,000,000 cycles), in accordance with ANSI/SDI A250.4 for Swing Test.
2. Door Face Sheets (chlorine environments): Stainless-steel, Type 316 alloy L (low carbon) in compliance with ASTM A666.
a. Sheet Thickness (Interior Doors): 18 gauge, 0.042 inch (1.0 mm), minimum.
b. Sheet Thickness (Exterior Doors): 16 gauge, 0.053 inch (1.3 mm), minimum.
c. Door Finish: No.4 - Brushed satin finish in accordance with ASTM A480/A480M.
3. Door Face Sheets: Stainless-steel, Type 304 or Type 316 alloy L (low carbon) in compliance with ASTM A666.
a. Sheet Thickness (Interior Doors): 18 gauge, 0.042 inch (1.0 mm), minimum.
b. Sheet Thickness (Exterior Doors): 16 gauge, 0.053 inch (1.3 mm), minimum.
c. Door Finish: No.4 - Brushed satin finish in accordance with ASTM A480/A480M.
4. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
5. Exterior Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
6. Door Thickness: 1-3/4 inches (44.5 mm).

J. Tornado-Resistant Doors:
1. Design and size door and frame components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M.
a. Design Wind Loads: Comply with requirements of authorities having jurisdiction.
b. Wind-Borne Debris Resistance: Door and frame components shall have FLA (PAD) approval, Miami (APD) approval, or UL (DIR) approval for Large and Small Missile impact and pressure cycling at design wind loads.
2. Tornado Shelter Application: Comply with ICC 500 standard.
3. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 4 - Maximum-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. All faced edge seams to be continuously wire welded, finished smooth.
d. Door Face Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
e. Zinc Coating for Exterior Doors: A60/ZF180 galvannealed coating; ASTM A653/A653M.
f. Provide construction, hardware reinforcement, and anchoring methods for Shelter Door Assembly doors in compliance with manufacturers approved listing.

4. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
5. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Frame Finish: Factory primed and field finished.
C. Exterior Door Frames: Full profile/continuously welded type and field insulated.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
2. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
3. Expanding Foam Insulation: Refer to Section 07 21 00 Insulation for product information.
4. Weatherstripping: Separate, see Section 08 71 00.
D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
2. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
E. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
3. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
F. ***SPECIFIER NOTE: Keep below for Detention HM Frames.***
G. Detention Security-Resistant Door Frames: With same security resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.
1. Interior and Exterior Frame Metal Thickness: 12 gauge, 0.093 inch (2.36 mm), minimum.
2. Interior Frame Finish: Factory primed and field finished.
3. Exterior Frame Finish: Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating..
a. Factory primed and field finished.
4. Hardware reinforcement:
a. Hinge and pivot: 7 gauge, 0.167 inch (4.2 mm) x 1-1/2 inch (38 mm) x 10 inch (254 mm) long steel strap reinforcement.
1) Spot welded in a triangular pattern at each end for a total of 6 welds per hinge and additionally reinforced by 7 gauge, 0.167 inch (4.2 mm) x 1-1/2 inch (38 mm) wide steel angle welded to the strap reinforcement.
b. Strike, closer and flush bolts: 7 gauge, 0.167 inch (4.2 mm) steel.
c. Surfaced applied hardware: 12 gauge, 0.093 inch (2.3 mm) steel.
d. Provide grout guards at all tapped reinforcement plates and glazing stops.
e. Jamb mounted security and mortised locks to have a one piece unitized pocket of 10 gauge, 0.123 inch (3.1 mm) steel.
5. Electrically Operated Hardware: UL approved 3/4 inch (19 mm) conduit with sweep elbows and connectors.
a. Access plates to be same gauge as door face and fastened with torx tamper resistant screws.
6. Anchors: Same gauge as frame.

a. Floor: Adjustable height.
b. Jamb:
1) Masonry: Adjustable strap and stirrup type.
2) Pre-finished masonry or concrete frame anchors: 7 gauge, 0.167 inch (4.2 mm) x 2 inch (51 mm) angle anchors 4 inch (102 mm) long.
(a) Embedded wall plate anchors: 7 gauge, 0.167 inch (4.2 mm) x 2 inch (51 mm) angle anchors 4 inch (102 mm) long welded in place to match frame anchors. Provide with two #4 re-bar wall anchors 10 inch (254 mm) long with 2 inch (51 mm) x 90° turn down on ends and continuously welded in place.
(b) The complete anchorage system to have removeable frame faces to be field welded on after frame installation.
3) Expansion bolt type:
(a) Frames prepped with countersunk hole for a 3/8 inch (9.5 mm) diameter expansion bolt field welded in place.

7. Removable glazing stops: 10 gauge, 0.123 inch (3.1 mm) pressed steel angle and anchored with tamper resistant screws.

H. Stainless-Steel Door Frames (chlorine environments): Provide full profile and continuously welded type in compliance with NAAMM HMMA 866, with Type 316 alloy L (low carbon) in compliance with ASTM A666.
1. Sheet Thickness (Exterior): 14 gauge, 0.067 inch (1.7 mm), minimum.
2. Sheet Thickness (Interior): 16 gauge, 0.053 inch (1.3 mm), minimum.
3. Frame Finish: Same as stainless-steel door finish in compliance with ASTM A480/A480M.

I. Stainless-Steel Door Frames: Provide full profile and continuously welded type in compliance with NAAMM HMMA 866, with Type 304 alloy or 316 alloy in compliance with ASTM A666.
1. Sheet Thickness (Exterior): 14 gauge, 0.067 inch (1.7 mm), minimum.
2. Sheet Thickness (Interior): 16 gauge, 0.053 inch (1.3 mm), minimum.
3. Frame Finish: Same as stainless-steel door finish in compliance with ASTM A480/A480M.

J. Tornado-Resistant Door Frames: With same tornado resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation in compliance with manufacturer's approved listing.
1. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.

K. Mullions for Pairs of Doors: Fixed, except where removable is indicated (Refer to Section 08 71 00) with profile similar to jambs.

L. Die coped frames at mullions and stops.

M. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

N. Transom Bars: Fixed, of profile same as jamb and head.

O. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted/insulated.

P. Frames in Masonry Walls: Size to suit masonry coursing with head member (size as detailed) high to fill opening without cutting masonry units.
1. Provide 16 gauge corrugated, adjustable, slip type standard frame anchors as follows:
3 anchors - for frames up to 7'-6" height jamb;
4 anchors for frames 7'-6" to 8'-0"
1 anchor for each 2' or fraction thereof in height for frames over 8'-0"
2. In labeled frames, anchors shall be non-removable.

Q. Hinge reinforcements to have 10 gauge straps welded directly above and below each hinge pocket.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORIES

A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.
   1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
   2. Style: Standard straight slat blade.
   3. Louver Free Area: 50% percent.
   4. Fasteners: Exposed, tamper proof fasteners.

B. Door Window Frames: Door window frames with glazing securely fastened within door opening.
   1. Size: As indicated on drawings.
   2. Frame Material: 18 gauge, 0.0478 inch (1.21 mm), galvanized steel.
   3. Metal Finish: Beige polyester powder coating.
   4. Glazing: 1/4 inch (6.4 mm) thick, tempered glass.

C. Glazing: As specified in Section 08 80 00, factory installed.

D. Removable Stops on secure side: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

E. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
   1. UL listed products in compliance with requirements of authorities having jurisdiction.
   2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
   3. Edge Type: Beveled edge
   4. Material: Manufacturers standard.
   5. Metal Finish: Beige powder coating.

F. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

G. Grout for Interior Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

H. Expanding Foam Insulation for Exterior Frames: Refer to Section 07 21 00 Insulation for requirements.

I. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

J. Temporary Frame Spreaders: Provide for factory- or shop-assembled attached to feet of jambs.

2.07 MODIFICATIONS TO EXISTING HOLLOW METAL

A. Where modifications to existing doors or frames are required to accept new doors or hardware, neatly make modifications in field per hardware templates. Provide flush metal blank off plates, welded in place, ground smooth, filled with body putty, where existing hardware is removed. Or, provide new door or frame conforming to project requirements.

2.08 ELECTRICAL REQUIREMENTS

A. Coordinate electrical requirements for doors and frames. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.

B. Doors with electric hinges:
   1. Furnish conduit raceway to permit wiring from electric door hardware.
   2. Hinge locations: Provide electric hinge at intermediate or center location.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.
C. Install detention doors and frames in accordance with HMMA-840 "Installation and Storage of Hollow Metal Doors and Frames".
D. Install tornado-resistant units in accordance with ICC 500 and manufacturer's published recommendations.
E. Coordinate frame anchor placement with wall construction.
    1. At steel columns and/or concrete surfaces, install sub-frame or rough bucks as specified. At steel columns use 5/16" diameter self-tapping metal screws and at concrete use expansion bolts of the same diameter. Install frame to sub-frame and/or rough buck with countersunk self-tapping metal screws. Fill screw holes with a suitable metallic filler, sand and prime.
    2. As masonry is being laid fill jambs solid with mortar and provide accurately cut wood spreaders temporarily at mid-section of frames, install jamb anchors.
    3. All field splices to be welded and filled with body putty and ground smooth, no exposed screw heads will be accepted. Locate splices where shown on final reviewed shop drawings.
F. Anchor placement for Detention frames (provide additional anchors as required for fire rated frames).
    1. Borrowed lite frames:
        a. 2 anchors plus 1 for each 18 inch (457 mm) or fraction thereof over 3 feet (914 mm), saced at 18 inch (457 mm) maximum between anchors.
    2. Door frames:
        a. 2 anchors plus 1 for each 18 inch (457 mm) or fraction thereof over 4 feet 6 inch (1372 mm), spaced at 18 inch (457 mm) maximum between anchors.
G. Grout interior frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
H. Insulate exterior frames with expanding foam insulation.
I. Install door hardware as specified in Section 08 71 00.
    1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
    2. For all attachments including removable stops, use flat head self-tapping screws. Drill and tap in the field for surface mounted closers, brackets, rim exit devices, door holders, and other surface hardware. At horizontal exterior surfaces, set screws with neoprene gaskets or set with caulking compound under screw head and wipe clean.
J. Coordinate installation of electrical connections to electrical hardware items.
K. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 FIELD QUALITY CONTROL

A. Testing and Special Inspection-Anchorage Installation.
    1. Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 45 33.
B. Personnel Qualifications:
    1. Special Inspector – Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in design of structural systems of the project type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection report.
C. The Owner will provide the following tests and inspections:
    1. Verification of post-installed anchor installation and capacity detailed in the window shop drawings.

3.07 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION 08 11 13

SECTION 08 14 23

CLAD WOOD DOORS (NON-WOLD MASTER - FOR REFERENCE ONLY)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clad wood doors with integral frames.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Perimeter seal of water-resistive barrier between clad wood door frame and adjacent construction.

B. Section 07 92 00 - Sealants (Non-Wold Master - For Reference Only): Sealing joints between frames and adjacent construction.

C. Section 08 71 00 - Door Hardware.

D. Section 08 80 00 - Glazing.

E. Section 09 91 23 - Interior Painting (Non-Wold Master - For Reference Only): Field finishing of doors.

F. Section 09 93 00 - Staining and Transparent Finishing (Non-Wold Master - For Reference Only): Field finishing of doors.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting prior to the start of the work of this section; require attendance by each affected installer.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door veneer, ____ by ____ inch (____ by ____ mm) in size illustrating wood grain, stain color, and sheen.

E. Performance Validation: Submit certified label or test report on products as indicated under performance requirements to validate product compliance.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging _____. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Doors with Exterior Aluminum Cladding and Interior Wood Facing:

1. Andersen Windows, Inc; Commercial Entry Doors: www.andersenwindows.com/#sle.
2. Marvin; Signature Ultimate Sliding Patio Door: www.marvin.com/#sle.
3. Pella Corp; ____: www.pellacommercial.com/#sle.

2.02 COMPONENTS

A. Clad Wood Doors: See drawings for locations and additional requirements.

B. Exterior Clad Wood Doors: Water-repellent and preservative-treated lumber in accordance with WDMA I.S. 4.

1. Thickness: 1-3/4 inches (44 mm), unless otherwise indicated.
2. Exterior Door Cladding: Aluminum sheet as indicated.
3. Exterior Frame Cladding: Extruded aluminum as indicated.
4. Interior Wood Facing, Transparent: Wood veneer for field finish as indicated.

C. Configuration: As indicated on drawings.
   1. Door Style: As indicated on drawings.
D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
   1. Apply silicone glazing sealant to exterior glazing stops as recommended by manufacturer.
   2. Apply water repellent treatment to wood glazing stops.
E. Door Stops: Clear preservative treated wood, finished to match frame.
F. Door Hardware: Manufacturer's standard.
   1. See Section 08 71 00 for balance of hardware not provided by door manufacturer.

2.03 DOOR INTERIOR WOOD FACINGS

A. Veneer Facing for Transparent Finish: Red Oak, veneer grade in accordance with requirements indicated, and plain sliced (flat cut), with book match between leaves of veneer, and running match of spliced veneer leaves assembled on door or panel face.
B. Door Edging: Any option allowed by quality standard for grade.
C. Wood Finish: Factory applied primer and field applied opaque finish.
   1. Field finish doors, see Section 09 91 23.
D. Facing Adhesive: Type I - waterproof.

2.04 DOOR EXTERIOR CLADDING

A. Aluminum Cladding: 6063-T5 aluminum cladding on exterior side, 0.045 inch (1.14 mm) minimum thickness, factory fabricated, factory glazed; complete with integral sloped sill/threshold, flashings, and anchorage devices.
B. Exterior Aluminum Finish: Class II color anodized.
C. Aluminum Members: Factory finished; solid corner construction; thermally broken.
D. Drainage: Provide drainage to exterior for moisture entering joints and glazing spaces and for condensation occurring within frame construction.

2.05 FABRICATION

A. Fabricate doors in accordance with door quality standard specified.
B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
D. Cut and configure exterior door edge to receive recessed weatherstripping devices.
E. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER INTERIOR FACE

A. Finish work in accordance with WDMA I.S. 1A for Grade specified and as follows:
   1. Transparent:
      a. System - TR-2, Catalyzed Lacquer.
      b. Stain: As selected by Architect.
      c. Sheen: Flat.
   2. Opaque:
      a. System - OP-2, Catalyzed Lacquer.
      b. Color: As selected by Architect.
      c. Sheen: Flat.
B. Factory finish doors in accordance with approved sample.
C. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
B. Assemble multiple units before installation in accordance with manufacturer's installation guidelines.

C. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
D. Field-Finished Doors: Trimming to fit is acceptable.
   1. Adjust width of doors by cutting equally on both jamb edges.
   2. Trim maximum of 3/4 inch (19 mm) off bottom edges.
E. Use machine tools to cut or drill for hardware.
F. Coordinate installation of doors with installation of integral frames and hardware.
G. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.
B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.
B. Adjust closers for full closure.

3.05 CLEANING

A. Remove protective material from factory finished surfaces.
B. Clean units using cleaning material and methods in accordance with door manufacturer's written recommendations.
C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.06 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.
B. Protect unit surfaces from masonry cleaning solution that could damage insulating glass panels, aluminum or wood finishing, and hardware.

END OF SECTION 08 14 23

SECTION 08 14 33
STILE AND RAIL WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Molded hardboard doors, stile and rail design; fire rated and non-fire rated.
   1. Solid Core.
   2. Hollow Core.
      a. Bifolds.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Indicate stile and rail core materials and construction; type and characteristics.
C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, and cutouts for louvers.
D. Samples: Submit two samples of door construction, 12 by 12 inches (304.8 by 304.8 mm) in size cut from top corner of door in specified finish.
E. Warranty, executed in Owner's name.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver, and store doors in accordance with quality standard specified.
B. Accept doors on site in manufacturer's packaging, and inspect for damage.
C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Interior Doors: Provide manufacturer's warranty for 5 years.
C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stile and Rail Hardboard Doors:
   1. Karona, Inc, a JenWeld Company: www.karonadoor.com.
   2. JenWeld Company: Molded Interior Doors; www.jenweld.com.
   3. Lynden Door: www.lyndendoor.com.
   4. Masonite Architectural; Aspiro Authentic Stile & Rail Doors: www.masonite.com.
   5. Simpson Door company: www.simpsondoor.com.
   6. VT Industries, Inc; Eggers Stile and Rail Collection: www.vtindustries.com.

2.02 DOORS

A. Quality Standard: Standard Duty performance, in accordance with WDMA I.S. 6A.
B. Interior Solid Core Doors: 1-3/4 inches (44.45 mm) thick unless otherwise indicated; veneer and lumber stile and rail construction; mortise and tenon joints. Opaque finish.
C. Interior Hollow Core and Bifold Doors: 1-3/8 inches (34.93 mm) thick unless otherwise indicated; manufacturers standard construction. Opaque finish.
D. Hardboard veneer facing with factory opaque finish.

2.03 DOOR AND PANEL FACINGS

A. Materials for Opaque Finishes: Hardboard faces.
B. Adhesive: Type I - Waterproof.
C. Door Design:
   1. Surface Finish: Textured.
   2. Profile:
      a. Sticking style:
         1) Square.
         2) Ovolo.

3) Classic.
4) Mission.

b. Panel style:
1) Flat.
2) Step.
3) Raised.
4) V-Grooved.

3. Panels: Square top.
a. Single panel:
1) Rectangular panel.

b. Two-panel:
1) Square panels.
2) Arch panels.
3) Lafayette panels.
4) Square vertical panels.

c. Three-panel:
1) Square-panels.

d. Four panel:
1) Square horizontal panels.
2) Square vertical panels.

e. Five panel:
1) Rectangular horizontal panels.

f. Six-panel:
1) Square vertical panels.
2) Rectangular horizontal panels.

D. Bifold Design:
1. Profile:
a. Sticking style:
1) Square.
2) Ovolo.
3) Classic.
4) Mission.

2. Panels: Square top.
a. Single panel:
1) Rectangular full louvered panel.
2) Rectangular panel.

2.04 DOOR CONSTRUCTION

A. Stiles for Double Doors: Provide fire retardant stiles that are listed/labeled when indicated without metal astegrals.
1. Provide with intemescent seals at rated door applications.

B. Astragals for Double Doors: Painted Steelto match door color, overlapping and recessed at face edge, specifically for double doors.
1. Provide with intemescent seals at rated door applications.

C. Vertical Exposed Edge of Stiles: Same as door faces.

D. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252 or UL 10B - Negative (Neutral) Pressure; listed in UL (DIR) or ITS (DIR) and without any visible seals when door is open.

G. Smoke and Draft Control Doors: In addition to required fire rating, provide stile and rail door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of

door opening at 0.10 inch water guage (24.9 Pa) pressure at both ambient and elevated temperatures for 'S' label; if necessary, provide additional gasketing or edge sealing.

2.05 MATERIALS

A. Particleboard Core Doors (without the appliction of panic/exit devices):
   1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde.
   2. Blocking: Provide wood blocking in particleboard-core doors as follows:
      a. 5 inch (127 mm) top-rail blocking, in doors indicated to have closers.
      b. 5 inch (127 mm) bottom-rail blocking, in doors indicated to have kick, mop, or armor plates.

B. Structural Composite Lumber Core Doors (for use with panic/exit devices):
   1. Structural Composite Lumber: WDMA I.S.10.
      a. Screw Withdrawal, Face: 700 lbf (96.78 kgm).
      b. Screw Withdrawal, Edge: 400 lbf (55.30 kgm).

C. 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 follows:
      a. 5 inch (127 mm) top-rail blocking.
      b. 5 inch (127 mm) bottom-rail blocking, in doors indicated to have protection plates.
      c. 5 inch (127 mm) midrail blocking, in doors indicated to have armor plates.
      d. 4-1/2 x10 inch (114.3 x 254 mm) lock blocks or 5 inch (127 mm) midrail blocking, in doors indicated to have exit/panic devices.
   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.
   4. Screw-Holding Capability: 400 lbf (55.30 kgm).

D. Hollow-Core Doors:
   1. Construction: Manufacturer's standard hollow core.
   2. Blocking: Provide wood blocking with minimum dimensions as follows:
      a. 5 x 18 inch (127 x 457.2 mm) lock blocks.

E. Hardboard: Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).

F. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.

G. Louvers:

2.06 FINISHES

A. Finish work in accordance with WDMA I.S. 6A for Grade specified and as follows:
   1. Opaque:
      a. System - OP-2, Catalyzed Lacquer.
      b. Color: See Interior Material Finish/Color Schedule on the Drawings.
      c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Door Hardware: See Section 08 71 00.

B. Door Hardware:
   1. Bi-fold Doors:
      a. Standard duty bi-fold closet door set.

C. Wood Louvers: Manufacturers standard wood species, oval style.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standards.

1. Install fire-rated doors in accordance with NFPA 80 requirements.
2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Machine cut for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Comply with specified quality standard for fit, clearance, and joinery tolerances.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

END OF SECTION 08 14 33

SECTION 08 31 00
ACCESS PANELS

TURN OFF FLOOR ACCESS PANELS
TURN OFF SECURITY ACCESS PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling mounted access panel.
B. Floor mounted access door and frame panels, interior.
C. Security access panels.
D. Fire rating of access panels as indicated on the Code Plan(s).
E. Provide and install one (1) additional access panel for each type over quantities shown on the drawings.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage/rusting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Any manufacturer who meets the requirements of the specification is acceptable.

2.02 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall/Ceiling-Mounted Panels for use in new drywall partitions and/or ceilings noted as AP #1 on drawings:
   1. Location: As indicated on drawings.
   2. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
   3. Panel Material: Stainless steel, Type 304.
   4. Size: 24 by 24 inches (609.6 by 609.6 mm).
   5. Door/Panel: Hinged, standard duty (14 gauge), with tool-operated spring and no handle.
   6. Door/Panel: Hinged, standard duty (14 gauge), with mortise lock prep (cylinder by Section 08 71 00) and no handle.
   7. Frame: 16 gauge.
   8. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
   9. Finish: Gray powdered primer.
   10. Finish: #4 Satin.
   11. Fire Rating: As required for panels in rated walls or ceilings. See Code Plan on Architectural Drawings for required rating.

B. Wall-Mounted Panels for use in new masonry or in renovated walls, noted as AP #2 on drawings:
   1. Location: As indicated on drawings.
   2. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
   3. Panel Material: Stainless steel, Type 304.
   4. Size: 24 by 24 inches (609.6 by 609.6 mm).
   5. Door/Panel: Hinged, standard duty (14 gauge), with tool-operated spring and no handle.
   6. Door/Panel: Hinged, standard duty (16 gauge), with mortise lock prep (cylinder by Section 08 71 00) and no handle.
   7. Frame: 16 gauge.
   8. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
   9. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
   10. Finish: Gray powdered primer.
   11. Finish: White powder coated, paintable.
   12. Finish: #4 Satin.
   13. Fire Rating: As required for panels in rated walls or ceilings. See Code Plan on Architectural Drawings for required rating.

C. Wall-Mounted Panels for use in new masonry or in renovated walls, noted as AP #3 on drawings:
   1. Location: As indicated on drawings.
   2. Panel Material: Stainless steel, Type 304.
   3. Size: 24 by 24 inches (609.6 by 609.6 mm).
   4. Door/Panel: Hinged, standard duty (16 gauge), with tool-operated spring and no handle.
   5. Door/Panel: Hinged, standard duty (16 gauge), with mortise lock prep (cylinder by Section 08 71 00) and no handle.
   6. Frame: 16 gauge.
   7. Wall Mounting Criteria (Renovation): Provide surface-mounted face frame and door surface flush with frame surface.
   8. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
   9. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
   10. Finish: #4 Satin
   11. Fire Rating: As required for panels in rated walls or ceilings. See Code Plan on Architectural Drawings for required rating.

2.03 FLOOR-MOUNTED ACCESS UNITS

A. Floor Mounted Access Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Size: 36 by 36 inches(914.4 by 914.4 mm).
   2. Units in Fire Rated Assemblies: Fire rating as noted on the Code Plan on Architectural Drawings.
      a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for the purpose indicated.
   3. Hardware: Stainless steel, Type 316.
      a. Hardware for Fire-Rated Units: As required for listing.
      b. Lock: Screw driver slot for quarter turn cam lock.
      c. Lock: Cylinder lock prep (cylinder by Section 08 71 00).

B. Interior Floor Mounted Access Units: Aluminum, minimum 1/4 inch (6 mm) thick noted as AP #4 on drawings.
   1. Design Load: Design to support live load of 300 psf (14 kPa) with deflection not to exceed 1/180 of span.
   2. Operation: Manual opening with automatic hold open arm (locks cover in open position), and manual closing.
   3. Frame: Extruded Aluminum Angle. Cast in for new construction and bolt in for renovation.
   4. Cover: recessed to accommodate schedule floor finish with edge molding.
   5. Lift Handle: Removable.

2.04 SECURITY ACCESS PANELS

A. Wall-Mounted Panels for use in masonry or concrete walls, noted as SAP #1 on drawings:
   1. Location: As indicated on drawings.
   2. Panel/Frame Material: Steel.
   3. Size: 24 by 48 inches (609.6 by 1219.2 mm).
   4. Door Panel/Stops: 10 gauge.
   5. Door Hardware:
      a. Butt Hinges, 4 x 4 inches (101.6 x 101.6 mm), welded to door and frame with pinned allen head security screws.
      b. Locks:
         1) Manufacturer/Products:
            (a) RR Brink Locking Systems:7010M; www.rrbrink.com.
            (b) Southern Steel: Model 1010A Deadlock; www.southernfolger.com.
         2) Mogul key cylinder.
   6. Frame: 2 x 2 x 3/16 inch (50.8 x 50.8 x 4.76 mm) steel angle.
   7. Finish: Gray powdered primer.

8. Finish: White powder coated, paintable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION 08 31 00

SECTION 08 53 13
VINYL WINDOWS

CLICK FOR 2020 MN ENERGY CODE
CLICK FOR 2018 IECC ENERGY CODE
CLICK FOR 2021 IECC ENERGY CODE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vinyl-framed, factory-glazed windows.
B. Operating hardware.
C. Insect screens.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide component dimensions, anchors, fasteners, glass, internal drainage, and manufacturer's technical data.
C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements, and glazing type, colors, muntin type, details of sill, jamb and head.
D. Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
E. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.
F. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
    1. Evidence of AAMA Certification.
    2. Evidence of WDMA Certification.
    3. Evidence of CSA Certification.
    4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
G. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.04 QUALITY ASSURANCE

A. Mockups: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
    1. Build mockup of typical wall assembly with vinyl window as indicated on Drawings.
    2. Contact manufacturer’s designated representative prior to vinyl window installation, to perform required mock-up visual inspection and analysis as required for warranty.
    3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
    4. Subject to compliance with requirements, approved mockups may become part of the completed Work.
B. Installer Qualifications: Company specializing in performing of type specified and with at least three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.
C. Store products in manufacturer's unopened packaging until ready for installation.
D. All windows and doors are to be handled and stored sill down in an upright position and not on sides or head.
E. No more than 8 patio doors and 12 windows are to be stored in a stack and keep out of direct sunlight.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
B. Maintain this minimum temperature during and after installation of sealants.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Manufacturer's Warranty:
1. UPVC Vinyl Frame and Sash Parts: 10 Years.
2. Window Hardware: 10 Years.
3. Insulated Glass Seal Failure: 20 Years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Windows:
1. Pella Corporation; Encompass by Pella Vinyl Windows: www.pellacommercial.com/#sle.
2. Thermo-Tech Premium Windows and Doors: Classic Series Vinyl; www.ttwindows.com.
3. Equivalent products by other manufacturer's are acceptable.

2.02 DESCRIPTION

A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
1. Configuration: As indicated on drawings.
a. Product Type in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
1) Casement.
2) Fixed/Direct Set.
2. Exterior Color:
3. Exterior Color:
4. Interior Color:
5. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
6. Operable Units: Multi-layered weatherstripping.
7. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
8. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
9. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
10. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame.
11. Insect Screens: Tight fitting for operating sash location.
12. Exterior trim:
a. Integral nailing fin.
b. Integral nailing fin with loose 3/4 inch (19.05 mm) snap-in J-channel.
c. 1-7/16 inch (37 mm) Brickmould.
d. 2 inch (51 mm) Brickmould.
e. 2 inch (51 mm) Brickmould with integral nailing fin.
f. 1-1/2 inch (38.1 mm) Brickmould with snap-on cover.
g. 2 inch (50.8 mm) Brickmould with snap-on cover.
h. 1-1/2 inch (38.1 mm) Brickmould with snap-on cover and 1 inch (25.4 mm) sub sill.
i. 2 inch (50.8 mm) Brickmould with snap-on cover and 1 inch (25.4 mm) sub sill.
13. Interior trim:
a. Jamb receptors to match interior window color.
1) 11/16 inch (17.46 mm).
2) 3/4 inch (19.05 mm).
b. Extension jambs:
1) Sized as required for wall depth, see drawings.
2) Vinyl wrapped to complement interior window color.
3) Unfinished oak (supplied by others).
4) Unfinished pine (supplied by others).
5) Unfinished birch (supplied by others).

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): R-40.

B. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, tested by independent agency and passed in accordance with ASTM E1996 for Wind Zone 4 - Additional Protection for Large and Small Missile impact and pressure cycling at design wind pressure.

C. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Provide capacity to withstand the following loads without deformation and without deflection greater than L/175 to spans up to 13'-6" (4114.8 mm) and L/240 + ¼ inch (6.25 mm) to spans greater than 13'-6" (4114.8 mm) with the following Wind Load Provision of ANSI/ASCE 7:
   2. Exposure Category = B.
   3. Exposure Category = C.
   4. Exposure Category = D.
   5. Occupancy Category = 1 with an Importance Factor of 0.87.
   6. Occupancy Category = 2 with Basic Wind Speed of 120 mph (193.12128 kph) and an Importance Factor of 1.00.
   7. Occupancy Category = 3 with a Basic Wind Speed of 125 mph (201.168 kph) and an Importance Factor of 1.15.
   8. Occupancy Category = 4 with a Basic Wind Speed of 130 mph (209.21472 kph) and an Importance Factor of 1.15.
   9. Mean Roof Height = ____ Feet (____ m)

D. Thermal Transmittance: Provide framing systems which have an overall U-valve (Btu/hr. x sq.ft. x deg. F) at 15 mph exterior wind velocity of not more than values shown in the table below when tested in accordance with NFRC 100 with specified glazing.
   1. 2020 Minnesota Energy Code:
      a. Zone 5 (and marine):
         1) Fixed Units Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F) (0.111367 W/(sq m K)), maximum.
         2) Operable Units Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.
         3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.
      b. Zone 6:
         1) Fixed Units Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
         2) Operable Units Overall U-value Including Glazing: 0.43 Btu/(hr sq ft deg F) (0.126021 W/(sq m K)), maximum.
         3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.
      c. Zone 7:
         1) Fixed Units Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
         2) Operable Units Overall U-value Including Glazing: 0.37 Btu/(hr sq ft deg F) (0.108436 W/(sq m K)), maximum.
         3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.
   2. 2018 IECC Energy Code:
      a. Zone 0 and 1:
         1) Fixed Units Overall U-value Including Glazing: 0.50 Btu/(hr sq ft deg F) (0.146536 W/(sq m K)), maximum.
         2) Operable Units Overall U-value Including Glazing: 0.65 Btu/(hr sq ft deg F) (0.190496 W/(sq m K)), maximum.

3) Entrance Door Overall U-value Including Glazing: 1.10 Btu/(hr sq ft deg F) (0.322378 W/(sq m K)), maximum.

b. Zone 2:
1) Fixed Units Overall U-value Including Glazing: 0.50 Btu/(hr sq ft deg F) (0.146536 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.65 Btu/(hr sq ft deg F) (0.190496 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.83 Btu/(hr sq ft deg F) (0.243249 W/(sq m K)), maximum.

c. Zone 3:
1) Fixed Units Overall U-value Including Glazing: 0.46 Btu/(hr sq ft deg F) (0.134813 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.60 Btu/(hr sq ft deg F) (0.175843 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.

d. Zone 4 (except marine):
1) Fixed Units Overall U-value Including Glazing: [0.38] Btu/(hr sq ft deg F) ([0.111367] W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225647 W/(sq m K)), maximum.

e. Zone 5 (and marine):
1) Fixed Units Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F) (0.111367 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.

f. Zone 6:
1) Fixed Units Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.43 Btu/(hr sq ft deg F) (0.126021 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.

g. Zone 7:
1) Fixed Units Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.37 Btu/(hr sq ft deg F) (0.108436 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.

h. Zone 8:
1) Fixed Units Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.37 Btu/(hr sq ft deg F) (0.108436 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.

3. 2021 IECC Energy Code:
a. Zone 0 and 1:

1) Fixed Units Overall U-value Including Glazing: 0.50 Btu/(hr sq ft deg F) (0.146536 W/(sq m K)), maximum.
2) Operable Unts Overall U-value Including Glazing: 0.62 Btu/(hr sq ft deg F) (0.181704 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.83 Btu/(hr sq ft deg F) (0.243249 W/(sq m K)), maximum.

b. Zone 2:
1) Fixed Units Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.113882 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.60 Btu/(hr sq ft deg F) (0.175843 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.77 Btu/(hr sq ft deg F) (0.225665 W/(sq m K)), maximum.

c. Zone 3:
1) Fixed Units Overall U-value Including Glazing: 0.42 Btu/(hr sq ft deg F) (0.123090 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.54 Btu/(hr sq ft deg F) (0.175843 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.68 Btu/(hr sq ft deg F) (0.199288 W/(sq m K)), maximum.

d. Zone 4 (except marine):
1) Fixed Units Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.63 Btu/(hr sq ft deg F) (0.184635 W/(sq m K)), maximum.

e. Zone 5 (and marine):
1) Fixed Units Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.63 Btu/(hr sq ft deg F) (0.184635 W/(sq m K)), maximum.

f. Zone 6:
1) Fixed Units Overall U-value Including Glazing: 0.34 Btu/(hr sq ft deg F) (0.099644 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.42 Btu/(hr sq ft deg F) (0.123090 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.63 Btu/(hr sq ft deg F) (0.184635 W/(sq m K)), maximum.

g. Zone 7:
1) Fixed Units Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
2) Operable Units Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
3) Entrance Door Overall U-value Including Glazing: 0.63 Btu/(hr sq ft deg F) (0.185635 W/(sq m K)), maximum.

h. Zone 8:
1) Fixed Units Overall U-value Including Glazing: 0.26 Btu/(hr sq ft deg F) (0.076198 W/(sq m K)), maximum.
2) Operable Untis Overall U-value Including Glazing: 0.32 Btu/(hr sq ft deg F) (0.093783 W/(sq m K)), maximum.

3) Entrance Door Overall U-value Including Glazing: 0.63 Btu/(hr sq ft deg F) (0.185635 W/(sq m K)), maximum.

E. Air Infiltration: Maximum 0.07 cfm/sq. ft. (0.00198 cm/m) at 1.57 psf (159080.3 pa) at 25 mph (40.23 kph) in accordance with ASTM E 283.

F. Water Resistance: No leakage when tested at 6.06 psf (614029.5 pa) in accordance with ASTM E 547.

G. Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required window assembly.

H. Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 34, when tested in accordance with ASTM E90 and ASTM E1332.

2.04 COMPONENTS

A. Frame Depth: 3-1/4 inches (82.6 mm).

B. Divided Lite Grid: Installed between panes of insulating glass, 5/8 inch (15.9 mm) wide flat grids, color to match frame and sash.
   1. Pattern: Manufacturer's standard layout.

C. Divided Lite Grid: Installed between panes of insulating glass, 3/4 inch (19.05 mm) wide sculptured grids, color to match frame and sash.
   1. Pattern: Manufacturer's standard layout.

D. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
   1. Hardware: Manufacturer's standard; quantity as required per screen.
   2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's 18 x 16 mesh.
   3. Frame Finish: Manufacturer's standard color complemented with window exterior.

E. Operable Sash Weatherstripping: Manufacturer's standard; permanently resilient, profiled to maintain weather seal in accordance with AAMA 701/702.

F. Fasteners: Stainless steel.

G. Accessories: Provide related flashings, anchorage and attachment devices as necessary for full assembly.

H. Glazing Sealant: Silicone.

I. Sealants for Setting Window Sill Pan Flashing: Provide butyl tape, non-hardening butyl, polyurethane, or silicone sealant; in compliance with ASTM E2112 installation practices.

2.05 HARDWARE

A. Lever handle and keeper with cam lock, provide at least one for each operating sash.

B. Finish of Exposed Hardware:
   1. Interior complementing color.
   2. Oil Rubbed Bronze.
   3. Antique Brass.

2.06 GLAZING PERFORMANCE

A. Single Hung Windows:
   1. Glazing: 3/4 inch (19mm) or 7/8 inch (22mm) dual pane insulated glass units utilizing warm edge spacer system and (2) panes of 1/8 inch (minimum) double strength glass secured to sash frame using a silicone sealant and glazing bead.
      a. Type: High Performance LoE² 272 with Argon.
         1) U-Factor: 0.30.
         2) Solar Heat Gain Coefficient (SHGC): 0.33 (No Grids), 0.30 (With Grids).
         3) Visible Light Transmittance: 0.56 (No Grids), 0.50 (With Grids).
         4) Condensation Resistance: 55.
      b. Type: Premium High Performance 366 LoE³ with Argon.
         1) U-Factor: 0.29.
         2) Solar Heat Gain Coefficient (SHGC): 0.22 (No Grids), 0.20 (With Grids).
         3) Visible Light Transmittance: 0.51 (No Grids), 0.45 (With Grids) .
         4) Condensation Resistance: 55.
   2. Color / Tint:
      a. Clear.
      b. Gray.

c. Bronze.

B. Direct Set Windows:
1. Glazing: 3/4 inch (19mm) or 7/8 inch (22mm) dual pane insulated glass units utilizing warm edge spacer system and (2) panes of 1/8 inch (minimum) double strength glass secured to frame using double sided glazing tape and glazing bead.
a. Type: High Performance LoE² 272 with Argon.
1) U-Factor: 0.27.
2) Solar Heat Gain Coefficient (SHGC): 0.37 (No Grids), 0.33 (With Grids).
3) Visible Light Transmittance: 0.64 (No Grids), 0.57 (With Grids).
4) Condensation Resistance: 56.
b. Type: Ultimate High Performance 366 LoE³ with Argon.
1) U-Factor: 0.27
2) Solar Heat Gain Coefficient (SHGC): 0.24 (No Grids), 0.22 (With Grids)
3) Visible Light Transmittance: 0.57 (No Grids), 0.51 (With Grids)
4) Condensation Resistance: 57.
2. Triple Glazing: 1-3/8 inch (35mm) Energy Guard triple pane insulated glass units with warm edge spacer system and (3) panes of 1/8 inch (minimum) double strength glass secured to sash frame using double sided glazing tape and glazing bead.
a. Type: Energy Guard PLUS Triple Insulated 272 LoE² with Argon.
1) U-Factor: 0.16.
2) Solar Heat Gain Coefficient: 0.31 (No Grids), 0.28 (With Grids).
3) Visible Light Transmittance: 0.51 (No Grids), 0.46 (With Grids).
4) Condensation Resistance: 71.
3. Color / Tint:
a. Clear.
b. Gray.
c. Bronze.

C. Casement Windows:
1. Glazing: 3/4 inch (19mm) or 7/8 inch (22mm) dual pane insulated glass units utilizing warm edge spacer system and (2) panes of 1/8 inch (minimum) double strength glass secured to sash frame using double sided glazing tape and glazing bead.
a. Type: High Performance LoE² 272 with Argon.
1) U-Factor: 0.27.
2) Solar Heat Gain Coefficient (SHGC):0.28 (No Grids), 0.26 (With Grids).
3) Visible Light Transmittance: 0.48 (No Grids), 0.43 (With Grids).
4) Condensation Resistance: 57.
b. Type: Premium High Performance 366 LoE³ with Argon.
1) U-Factor: 0.27.
2) Solar Heat Gain Coefficient (SHGC): 0.19 (No Grids), 0.17 (With Grids).
3) Visible Light Transmittance: 0.43 (No Grids), 0.39 (With Grids).
4) Condensation Resistance: 57.
2. Glazing: 1-3/8 inch (35mm) triple pane insulated glass units with warm edge spacer system and (3) panes of 1/8 inch (minimum) double strength glass secured to sash frame using double sided glazing tape and glazing bead.
a. Type: Energy Guard PLUS Triple Insulated 272 LoE² with Argon.
1) U-Factor: 0.19.
2) Solar Heat Gain Coefficient: 0.24 (No Grids), 0.22 (With Grids).
3) Visible Light Transmittance: 0.38 (No Grids), 0.34 (With Grids).
4) Condensation Resistance: 70.
3. Color / Tint:
a. Clear.
b. Gray.
c. Bronze.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive this work.

3.02 INSTALLATION

A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.
B. Install windows in accordance with ASTM E2112.
C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.
D. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.
E. Set sill members and sill flashing in continuous bead of sealant.
F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
G. Install operating hardware.
H. Install glass in accordance with glazing method required to achieve performance criteria.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

3.04 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

A. Remove protective material from pre-finished surfaces.
B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer and appropriate for application indicated.

END OF SECTION 08 53 13

SECTION 08 54 13
FIBERGLASS WINDOWS AND DOORS

CLICK TO TURN OFF 2020 MN ENERGY CODE
CLICK TO TURN OFF 2018 IECC ENERGY CODE
CLICK TO TURN OFF 2021 IECC ENERGY CODE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory fabricated fiberglass windows with:
   1. Fixed sash.
   2. Operating sash and hardware.
      a. Insect screens.

B. Factory fabricated fiberglass sliding doors.

C. Glazed by factory.

D. Insect screens at operable units..

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage details.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation details and requirements.

D. Samples: Submit two, 6 inch (152.4 mm)long in size, illustrating window frame section and specified color.

E. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owners's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Mockups: Build mockups to set quality standards for fabrication and installation.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide twenty year manufacturer warranty for fiberglass frame components.

C. Provide ten year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and integral hardware including replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Windows and Doors:
   1. Andersen Windows & Doors; 100 Series: www.andersenwindows.com.
   2. Cascadia Windows & Doors; CASCADIA UNIVERSAL SERIES Windows: www.cascadiawindows.com.
   3. Marvin; Essential Windows: www.marvin.com.
   4. Pella Corporation; Pella Impervia Windows: www.pellacommercial.com.

2.02 WINDOW AND DOOR UNITS

A. Fiberglass Windows and Doors: Hollow, tubular, multi-layer fiber reinforced material; factory fabricated; with vision glass, related flashings, anchorage and attachment devices.
   1. Configuration: As indicated on drawings.
   2. Product Type in accordance with AAMA/WDMA/CSA 101/I.S.2/A440:
      a. Awning projected window.
      b. Casement window.
      c. Fixed widow.
      d. Single-hung.
      e. Double-hung.
      f. Sliding Door.
   3. Color:
      a. White.
      b. Sandelwood/Sandtone.
      c. Terratone.
      d. Brown/Dark Bronze.
      e. Black.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window/sliding door type:
   1. Performance Grade (PG): Equivalent to or greater than design wind load.
B. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
C. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
D. Thermal Movement: Design to accommodate thermal movement caused by 100 degrees F (34 degrees C) temperature change without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.
E. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Provide capacity to withstand the following loads without deformation and without deflection greater than L/175 to spans up to 13’-6” (4114.8 mm) and L/240 + ¼ inch (6.25 mm) to spans greater than 13’-6” (4114.8 mm) with the following Wind Load Provision of ANSI/ASCE 7:
   2. Exposure Category = B.
   3. Exposure Category = C.
   4. Exposure Category = D.
   5. Occupancy Category = 1 with an Importance Factor of 0.87.
   6. Occupancy Category = 2 with Basic Wind Speed of 120 mph (193.12128 kph) and an Importance Factor of 1.00.
   7. Occupancy Category = 3 with a Basic Wind Speed of 125 mph (201.168 kph) and an Importance Factor of 1.15.
   8. Occupancy Category = 4 with a Basic Wind Speed of 130 mph (209.21472 kph) and an Importance Factor of 1.15.
   9. Mean Roof Height = "____" Feet ("_____" m).
F. Thermal Transmittance: Provide framing systems which have an overall U-valve (Btu/hr. x sq.ft. x deg. F) at 15 mph exterior wind velocity of not more than values shown in the table below when tested in accordance with NFRC 100 with specified glazing.
   1. 2020 Minnesota Energy Code:
      a. Zone 5 (and marine):
         1) Fixed Window Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F) (0.111367 W/(sq m K)), maximum.
         2) Operable Window Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.
      b. Zone 6:

1) Fixed Window Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.43 Btu/(hr sq ft deg F) (0.126021 W/(sq m K)), maximum.

c. Zone 7:
1) Fixed Window Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.37 Btu/(hr sq ft deg F) (0.108436 W/(sq m K)), maximum.

2. ***SPECIFIER NOTE: U-values below are based on the 2018 IECC.***

3. 2018 IECC Energy Code:
a. Zone 0 and 1:
1) Fixed Window Overall U-value Including Glazing: 0.50 Btu/(hr sq ft deg F) (0.146536 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.65 Btu/(hr sq ft deg F) **(**0.190496 W/(sq m K)), maximum.

b. Zone 2:
1) Fixed Window Overall U-value Including Glazing: 0.50 Btu/(hr sq ft deg F) (0.146536 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.65 Btu/(hr sq ft deg F) (0.190496 W/(sq m K)), maximum.

c. Zone 3:
1) Fixed Window Overall U-value Including Glazing: 0.46 Btu/(hr sq ft deg F) (0.134812 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.60 Btu/(hr sq ft deg F) (0.175843 W/(sq m K)), maximum.

d. Zone 4 (except marine):
1) Fixed Window Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F) (0.111367 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.

e. Zone 5 (and marine):
1) Fixed Window Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F) (0.111367 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.

f. Zone 6:
1) Fixed Window Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.43 Btu/(hr sq ft deg F) (0.126021 W/(sq m K)), maximum.

g. Zone 7:
1) Fixed Window Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.37 Btu/(hr sq ft deg F) (0.108436 W/(sq m K)), maximum.

h. Zone 8:
1) Fixed Window Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.37 Btu/(hr sq ft deg F) (0.108436 W/(sq m K)), maximum.

4. 2021 IECC energy Code:
a. Zone 0 and 1:

1) Fixed Window Overall U-value Including Glazing: 0.50 Btu/(hr sq ft deg F) (0.146536 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.62 Btu/(hr sq ft deg F) (0.181704W/(sq m K)), maximum.

b. Zone 2:
1) Fixed Window Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.60 Btu/(hr sq ft deg F) (0.175843 W/(sq m K)), maximum.

c. Zone 3:
1) Fixed Window Overall U-value Including Glazing: 0.42 Btu/(hr sq ft deg F) (0.123090 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.54 Btu/(hr sq ft deg F) (0.158258 W/(sq m K)), maximum.

d. Zone 4 (except marine):
1) Fixed Window Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.

e. Zone 5 (and marine):
1) Fixed Window Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.

f. Zone 6:
1) Fixed Window Overall U-value Including Glazing: 0.34 Btu/(hr sq ft deg F) (0.099644 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.42 Btu/(hr sq ft deg F) (0.123090 W/(sq m K)), maximum.

g. Zone 7:
1) Fixed Window Overall U-value Including Glazing: 0.29 Btu/(hr sq ft deg F) (0.084991 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F) (0.105506 W/(sq m K)), maximum.

h. Zone 8:
1) Fixed Window Overall U-value Including Glazing: 0.26 Btu/(hr sq ft deg F) (0.076198 W/(sq m K)), maximum.
2) Operable Window Overall U-value Including Glazing: 0.32 Btu/(hr sq ft deg F) (0.093783 W/(sq m K)), maximum.

G. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 9.19 pounds per square foot (440 Pa).

H. Air Leakage: 0.3 cfm/sq ft (1.5 L/sec sq m) maximum leakage when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.

I. Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 34, when tested in accordance with ASTM E90 and ASTM E1332.

J. Forced Entry Resistance for Window Type A: Comply with ASTM F588 for measured performance of Grade 10 in accordance with requirements.

2.04 COMPONENTS

A. Window Frames: 3 inch (76.2 mm) deep profile.

B. Sliding Door Frames: 5 inch (127 mm) deep profile.
1. Type: Nailing flange (for new windows).
2. Type: Flush Flange.
3. Type: Block type (for replacement windows).

4. Frame Corners: Mitered and joined with nylon corner locks.

C. Window Sills: pultruded fiberglass; sloped for positive wash; fit under sash to 1/2 inch (12 mm) beyond wall face; one piece full width of opening.

D. Sliding Door Sills: Extruded aluminum handicapped accessible sill filler.

E. Grilles:
   1. Surface mounted, simulated divided lite, and bonded to outer glazing surface.
      a. Material: 7/8 inch (22.2 mm) wide contoured profile, composite material.
      b. Material: 1-1/4 inch (31.8 mm) wide, beveled edge, fiberglass.
      c. Color: Match exterior sash.
      d. Pattern: As indicated on the drawings.

F. Between-the-glass:
   1. Material: Aluminum.
   2. Size: 11/16 inch (17 mm).
   3. Shape:
      a. Contoured.
      b. Pencil.
      c. Rectangular.
   4. Color: Match exterior sash.
   5. Pattern: As indicated on the drawings.

G. Insect Screen Frame: Rolled aluminum frame of rectangular sections; fit with adjustable hardware; nominal size similar to operable glazed unit. For sliding doors, top hung adjustable nylon rollers, frame mounted strike, necessary hardware.
   1. Insect Screens: Woven fiberglass mesh; 14/18 mesh size.
      a. Color: Black.

H. Operable Sash/ Sliding Door Weather Stripping: Manufacturer's standard; permanently resilient, profiled to effect weather seal.

I. Fasteners: Stainless steel.

J. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

K. Interior Insulating-Foam Sealant: Great Stuff; Window and Door: www.greatstuff.dupont.com. Low-expansion, low-pressure polyurethane insulating window and door foam sealant.

2.05 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: See Section 08 80 00 for Types described below:
   1. Double glazed insulating units, Low E on surface 3, argon filled.
   2. Triple glazed insulating units, Low E on surfaces 2 & 5, argon filled.

2.06 HARDWARE

A. Casement and Awning Sash: Zinc die-cast steel worm-gear operator with Painted finish.
   1. Operator Linkage, Hinge Slide, and Hinge Arms: 300 series stainless steel.
   2. Casement and Awning Sash Lock: Folding arm crank.

B. Horizontal Sliding Sash: Extruded PVC interfacing tracks, limit stops in head and sill track.
   1. Sash Lock: Cam lock and keeper.

C. Double Hung Sash: Metal and nylon spiral friction slide cylinder, each sash, each jamb.
   1. Sash Lock: Self-aligning, cam-action lock.

D. Sliding Door: Interior and exterior handles. Inside thumb lock with exterior key lock.
   1. Multiple-Point Lock Hardware: Electroplated steel with stainless steel adjustable strike.
   2. Vent panel Rollers: Two adjustable, permanently sealed, electroplated steel with organic coating, ball-bearing rollers, set on stainless steel track.

E. Window Opening Control Devices (WOCD): Provide operable window sash hardware that limits openings to only allow passage of 4 inch (102 mm) diameter rigid sphere or less, and are easily releasable to fully open without use of keys, tools, or special knowledge.

F. Finish for Exposed Hardware:
   1. Match window finish.
   2. Satin nickel.
   3. Oil-rubbed bronze.

4. Bright Brass.

2.07 FABRICATION

A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
B. Form sills and stools in one piece. Slope sills for wash.
C. Form snap-in glass stops, closure molds, weather stops, and flashings for tight fit into window frame section.
D. Form weather stop flange to perimeter of unit.
E. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
F. Arrange fasteners to be concealed from view.
G. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.
H. Operable units:
   1. Assemble insect screen frame, miter and reinforced frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
   2. Double weatherstrip operable units.
I. Factory glaze window units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install windows/doo in accordance with manufacturer's instructions.
B. Attach window/do frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
C. Align window/do plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
D. Set sill members and sill flashing in continuous bead of sealant.
E. Provide thermal isolation where components penetrate or disrupt building insulation. Install foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
F. Install operating hardware when operating units are provided.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

3.04 FIELD QUALITY CONTROL

A. Provide services of fiberglass window/door manufacturer's field representative to observe for proper installation of system and submit report.
B. The Owner may provide field testing of installed fiberglass windows by independent laboratory hired in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
   1. Perform tests on three individual windows and or doors in designated locations as directed by Architect.
   2. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf (91 Pa).
   3. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 6.27 psf (300 Pa).
      a. Maximum allowable rate of air leakage is 1.5 times specified rate of 0.10 cfm/sq ft (0.5 L/s sq m) as indicated in AAMA/WDMA/CSA 101/I.S.2/A440.
C. For each test that fails, the Architect/Testing Agent will select two additional windows/doors to be tested. All unsuccessful tests, both original and retest as well as additional windows/doors to be tested due to an unsuccessful test will be paid by the Contractor by deduct change order.
D. Attendance at the window/door testing is required for the window manufacturer (or a designated representative) the installing Contractor, General Contractor or Construction Manager.

3.05 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION 08 54 13

SECTION 08 57 00
ALUMINUM WOOD COMPOSITE WINDOWS

TURN OFF 2018 IECC ENERGY CODE

PART 1 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, tools, equipment and services to furnish and install commercial-grade aluminum/wood composite direct set windows and related components.

1.02 QUALITY ASSURANCE

A. General: Provide aluminum/wood composite window units with integral weepage system that meet or exceed performance requirements specified:
   1. AAMA/WDMA/CSA 101/I.S. 2/A440-08, rating shall be: AP-AW70 or FW-AW70. Windows must meet AW testing requirements including life cycle testing. [Higher performance available upon request]

B. Testing: Test each type and size of required window unit through a recognized Independent Testing Laboratory or Agency, in accordance with ASTM E283 for air infiltration, and with ASTM E331 for water penetration.
   1. Air Infiltration: Exterior windows will not exceed 0.10 CFM per lineal foot of sash crack when tested in accordance with ASTM E 283-04 at a uniform pressure of 6.24 PSF.
   2. Water Resistance: No water leakage will occur when tested in accordance with ASTM E 331-00 at a static pressure equaling 20% of the specified design pressure up to a maximum of 12.00 PSF.
   3. Condensation Resistance Factor of Frame: 65, measured in accordance with AAMA 1503.
   4. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
      a. Provide capacity to withstand the following loads without deformation and without deflection greater than L/175 to spans up to 13’-6” (4114.8 mm) and L/240 + ¼ inch (6.25 mm) to spans greater than 13’-6” (4114.8 mm) with the following Wind Load Provision of ANSI/ASCE 7:
      b. Exposure Category = B.
      c. Exposure Category = C.
      d. Occupancy Category = 2 with Basic Wind Speed of 120 mph (193.12128 kph) and an Importance Factor of 1.00.

C. Thermal Transmittance: Provide framing systems which have an overall U-valve (Btu/hr. x sq.ft. x deg. F) at 15 mph exterior wind velocity of not more than values shown in the table below when tested in accordance with NFRC 100 with specified glazing.
   1. 2018 IECC Energy Code:
      a. Zone 5 (and marine):
         1) Fixed Window Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F) (0.111367 W/(sq m K)), maximum.
         2) Operable Window Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (0.131882 W/(sq m K)), maximum.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle window units fully crated and packaged to protect from damages.

B. Store window units upright and protected from the environment in a water tight secured location.

1.04 WARRANTY

A. Window Warranty: Submit a written warranty, executed by the Window Manufacturer, against defects in material and workmanship of the windows under normal use.

B. Glass: Warranty period starts from the date of manufacture printed on the insulated glass spacer. Insulating glass shall be warranted against obstruction of vision between interior glass surfaces (seal failure) for a period of 10 years.

C. Exterior Finishes: 10 years from the date of manufacture.

D. Materials and Workmanship: 10 years from the date of manufacture.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. H Window Company: www.hwindow.com.

B. Pella Corporation: www.pella.com.
C. Marvin Windows: www.marvin.com.

2.02 MATERIALS

A. Extruded Aluminum: (Exterior) 6063-T6 tempered aluminum frame, sash and glazing stop. Minimum wall thickness to be 0.055 inches. Roll-formed aluminum is not acceptable.
B. Interior Wood: Kiln dried to a moisture content of 6-12 percent and preservative treated. Wood frame and sash will be a minimum of 1-1/4" thick.
   1. Species: See Interior Material Finish/Color Schedule on the Drawings.
C. Insulating Glass: CBA rated dual seal clear insulating 3-pane glass, 1-3/8" thick O.A.; DSB glass interior and exterior with High Performance Low-E on surface #2 and #5, argon gas filled and warm edge spacer technology.
D. Weather-stripping: Full perimeter high performance weather gasket.
E. Sealant: Provide products and conform to requirements specified in Section 07 92 00.

2.03 WINDOW TYPE

A. Window Type: Direct set windows.
B. Configure as indicated on the elevation drawings and window details.

2.04 FABRICATION

A. Corner Joinery: Sash and Frame
B. Wood fabrication: Mortise and tenon joints. Glued, stapled and caulked.
C. Aluminum fabrication: Sash: 45 degree mitered corners, double crimped to extruded aluminum corner keys. Frame: Butt jointed corners sealed with gaskets and silicone.
D. Composite Frame Construction: Fabricate window units with a continuous butyl tape or closed cell foam thermal/moisture barrier, located between exterior aluminum and interior wood. Aluminum is nailed to wood with stainless steel ring-shanked nails on 6 inch spacing around perimeter of frame and sash.
E. Weep System: Windows must have an integral weep system to allow proper water management to the exterior.
F. Wood Surfaces: Wood shall be smooth and free of surface defects.
G. Insulated Glass: Glazing shall be factory-installed utilizing dry-glazed system to minimize stress on glass seals and to allow for ease of glass replacement.

2.05 FINISHES

A. Exterior:
   1. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.
   2. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick.
   3. Color : White
B. Interior Wood: All visible interior wood components in the window including extension jambs and mull covers shall be factory pre-finished. Utilize a 3-coat post-catalyzed conversion varnish sprayed finish by the window manufacturer prior to window assembly.
   1. Wood Color: Painted White
C. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact cementitious or dissimilar materials.
D. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A386 to 2.0 oz/sq. ft. or primed with iron oxide paint.

2.06 ACCESSORIES

A. Positioning Fin: Attach vinyl positioning fin with pre-punched installation holes.
B. Mull Covers: Exterior aluminum, interior wood.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are clean, dry and ready to receive work of this Section. Verify that rough opening and masonry openings are correct and the sill plate is level.

3.02 PREPARATION

A. Remove new windows from crating and packaging material. Verify that all parts and accessories are included. All window units shall be securely stored, upright and protected from the environment.

3.03 INSTALLATION

A. Install window frames, glazing and reinforcement in strict accordance with manufacturer's instruction and shop drawings.

B. Align window frame plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

C. Coordinate attachment and seal of weather barrier materials. Install undersill and sill flashing.

D. Use low expanding foam intended for window installation only in shim spaces at perimeter to maintain continuity of thermal barrier.

E. Install perimeter sealant and backing materials to meet local and national codes.

3.04 ADJUST AND CLEAN

A. Remove protective material from glass or pre-finished aluminum surfaces if present.

B. Wash down exposed surfaces using a solution of mild detergent in warm water applied with soft, clean wiping cloth. Take care to remove dirt from corners. Remove dirt and window label. Wipe surfaces clean.

C. Remove excess sealant by moderate use of solvent acceptable to sealant manufacturer.

D. Protect exterior finishes until cleaning of the exterior building is completed.

END OF SECTION 08 57 00

SECTION 08 71 00
FINISH HARDWARE

TURN OFF FOR NEW BUILDINGS (EXIST BUILDING NOTES)
TURN OFF MORTISE LOCKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for the following doors:
   1. Aluminum (except weatherstripping).
   2. HM.
   3. Wood.
B. Electrically operated and controlled hardware.
C. Thresholds.
D. Weatherstripping and gasketing.
E. Coat hooks on the back of Office Doors and Toilet doors
F. Verification of existing locks and cylinder types for re-keying of entire building.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
D. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
   1. Agenda:
      a. Rough-in of electrical box locations.
      b. Review power requirements of all hardware and coordinated with the site electrician.
      c. Review installation manuals, hardware schedule, installation templates and physical product samples for:
         1) Locksets.
         2) Closers, including accessibility closers/button locations.
         3) Exit Devices.
         4) Miscellaneous hardware.
         5) Hardware mountable weatherstrip for exterior doors.
         6) Overhead stops.
         7) All low voltage hardware.
   2. Attendance is required by affected installers and the following:
      a. Hardware manufacturer(s) representative.
      b. Hardware Installer.
      c. Owner's Representative and Security Consultant if applicable.
      d. General Contractor or Construction Manager.
      e. Electrician.
   3. Contractor is to take meeting minutes and distribute to attendees and Architect.
E. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. General Contractor or Construction Manager.
      b. Owner's Representative and Security Consultant if applicable.
      c. Architect.
      d. Hardware supplier.
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.

4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
    a. Access control requirements.
    b. Key control system requirements.
    c. Schematic diagram of preliminary key system.
    d. Flow of traffic and extent of security required.
5. Contractor to record minutes and distribute copies within seven days after meeting to participants, with ____ copies to Architect, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
1. List groups and suffixes in proper sequence.
2. Provide complete description for each door listed.
3. Provide manufacturers and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
2. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. For existing buildings, field verify existing swings and functions prior to submitting schedule.

F. For existing buildings being re-keyed, field verify type and quantity of cylinders required prior to submitting schedules.
1. Itemize hardware in the sequence and format established by this specification.
    a. List and describe each opening separately; include door number, room designations, degree of swing, and hand.
    b. List related details; include dimensions, door and frame material, and other conditions affecting hardware.
    c. List all hardware items; include manufacturer's name, quantity, product name, catalog number, size, finish, attachments, and related details where applicable.
    d. Submit manufactures cut sheets on each type of hardware proposed.
    e. Resubmit the corrected schedule when required.
    f. Determine keying requirements by meeting with the Owner coordinated through the Architect, and submit a detailed keying schedule for review; resubmit the corrected schedule when required.

G. Samples for Verification:
1. Samples: Identify each sample and indicate the location of subsequent installation in the project.
    a. Submit the following samples:
        1) Typical Rim Exit device.
        2) Typical lockset.

H. Keying Schedule:
1. Submit one PDF copy of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

1.04 QUALITY ASSURANCE/REGULATORY REQUIREMENTS

A. Except where specified in the hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Supplier: Company specializing in the builders' hardware industry.
C. Provide hardware for fire-rated openings conforming in compliance with IBC and NFPA 80 (Adopted Editions by AHJ).
D. Furnish hardware listed by UL testing agency for all rated openings in conformance with requirements for the class of opening scheduled.
E. Rating requirements have precedence over this specification where conflict exists.
F. Furnish and install hardware that is in compliance with American with Disabilities Act (ADA) technical standards, and Building Code (Adopted Edition by AHJ).
G. Templates: Furnish a copy of the approved hardware schedule and all pertinent templates or template information to each fabricator of material factory-prepared for the installation of hardware.
H. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least five years of documented experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.
B. Store hardware in dry surroundings and protect against loss and damage.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
B. Provide individual items of single type, of same model, and by same manufacturer.
C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   4. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   5. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
   1. See Division 28 for additional access control system requirements.
E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.
F. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide wall grip inserts for hollow wall construction.
   5. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.

6. Provide sex bolts for closers on wood doors.
7. Fire-Rated Applications: Comply with NFPA 80.
    a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

A. Manufacturers:
1. McKinney, Markar an Assa Abloy Group company: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com.
3. Ives, an Allegion brand: www.allegion.com.
4. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com.

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Provide hinges on every swinging door.
2. Provide ball-bearing hinges at each door with closer.

C. Butt hinge manufacturers, types and respective catalog numbers:
1. Steel based, Standard-weight, ball bearing, full mortise:
    a. Ives: 5BB1.
    b. Hager: BB1279.
    c. Stanley: FBB179.
    d. McKinney: TB2714.
2. Non-ferrous based, standard-weight, ball bearing, full mortise:
    a. Ives: 5BB1 630.
    b. Hager: BB1191.
    c. Stanley: FBB191.
    d. McKinney: TB2314.

D. Continuous hinges manufacturers and respective catalog numbers:
1. Ives: 700 Series.
2. Markar: 300 Series
3. Stanley: 600 Series.
    a. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 pounds. Edge mount (unless noted otherwise).
    b. Hinges shall be constructed of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of .25 and the exterior barrel diameter of .438.
    c. Hinge shall be non-handed with symmetrical templated hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.
    d. Each knuckle to be 2", including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.
    e. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to three hours. Note: Fire label for doors and frames should be placed on the header and top rail of rated doors and frames.
    f. Provide adjusting screws equal to Markar's "AdjustaScrew" for continuous hinges specified as HG-305. Adjustment to be able to correct frame fit problems up to 3/8".

E. When hinges are specified on the hardware schedule, furnish:
1. Interior openings through 36 inches wide and 90 inches high without a door closer: Three (3) steel based, standard-weight, plain bearing, full mortise hinges per leaf per leaf.
    a. For use at corrosive environments (swimming pools, showers, toilet stall doors) use Three (3) non-ferrous based, standard-weight, plain bearing, full mortise hinges per leaf.
2. Interior openings through 36 inches wide and 90 inches high with a door closer: Three (3) steel based, standard-weight, ball bearing, full mortise hinges per leaf.
    a. For use at corrosive environments (swimming pools, showers, toilet doors) use Three (3) non-ferrous based, standard-weight, ball bearing, full mortise hinges per leaf.
3. Exterior HM, FRP or stainless steel openings: One (1) continuous hinge per leaf.

4. Exterior aluminum openings through 36 inch wide and 90 inches high: Four (4) non-ferrous based, heavy-weight, ball bearing, full mortise, non-removable pin hinges per leaf.
5. Exterior aluminum openings over 36 inches wide in width and/or 90 inches in height: One (1) continuous hinge per leaf.
6. Exterior aluminum openings: One (1) continuous hinge per leaf.

2.03 FLUSH BOLTS AND DUSTPROOF STRIKES

A. Manufacturers:
1. Door Controls International: www.doorcontrols.com.
2. Rockwood, an Assa Abloy Group company: www.assaabloydss.com.
3. Hager Companies: www.hagerco.com.
4. Ives, an Allegion brand: www.allegion.com/us.

B. Non-labeled opening flush bolts for inactive leaf of locked or unlocked doors:
1. Ives: FB458.
2. Door Contols: 780.
3. Hager: 282D.
4. Rockwood: 550.
   a. Locate centerline of the top bolt not more than 78" from the finished floor.

C. Labeled opening automatic flush bolts for the inactive leaf of doors:
1. Ives: FB31P or FB41P.
2. Door Controls: 842 or 942.
3. Hager: 292D or 291D.
4. Rockwood: 1842 or 1942.

D. Dustproof strike for bottom bolts:
1. Ives: DP2.
2. Door Controls: 80.
3. Hager: 280X.
4. Rockwood: 570.

2.04 EXIT DEVICES

A. Manufacturers:
1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company; ED5000 Series, 80 Series, 7000 Series: www.assaabloydss.com.
   a. Keyed removable mullions:
      1) Corbin-Russwin: CR900 Series.
      2) Sargent: L980 Series.
      3) Yale: KRM200 Series.
   b. Vandal resistant levers:
      1) Corbin-Russwin: Free Wheeling Vandal Resistant Series.
      2) Sargent: Free Wheeling Trim Series.
      3) Yale: Free Wheeling Trim Series.
   c. Mullion stabilizers/Blade stop strikes:
      1) Corbin-Russwin: 653F11-1 x 628
      2) Sargent: 651/657.
      3) Yale: 102S.
2. Precision, dormakaba Group; APEX 2000 Series: www.precisionhardware.com.
   a. Keyed removable mullions: KR822/FLKR822 Series.
   b. Vandal resistant levers: V4900.
   c. Mullion stabilizers/Blade stop strikes:ST989/S988.
3. Von Duprin, Falcon; an Allegion brand; 99 Series, 25 Series: www.allegion.com/us.
   a. Keyed removable mullions:
      1) Von Duprin: KR4954/KR1654/KR9954.
      2) Falcon: KR-4023/KRF-4023.
   b. Vandal resistant levers:
      1) Von Duprin: 996L.

2) Falcon: 511L.
c. Mullion stabilizers/Blade stop strikes:
1) Von Duprin: 154/1439.
2) Falcon: 525/565.
4. Von Duprin, an Allegion brand; 99 Series: www.allegion.com/us.
a. Keyed removable mullions: KR4954/KR1654/KR9954.
b. Vandal resistant levers: 996L.
c. Mullion stabilizers/Blade stop strikes: 154/1439.
5. Precision, dormakaba Group; APEX 2000 Series: www.precisionhardware.com.
a. Keyed removable mullions: KR822/FLKR822 Series.
b. Vandal resistant levers: V4900.
c. Mullion stabilizers/Blade stop strikes: ST989/S988.
6. Von Duprin, an Allegion brand; 99 Series: www.allegion.com/us.
a. Keyed removable mullions: KR4954/KR1654/KR9954.
b. Vandal resistant levers: 996L.
c. Mullion stabilizers/Blade stop strikes: 154/1439.

B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Furnish exit device series and functions specified in the hardware schedule.
2. Furnish sex bolt attachments for devices specified for mineral core door application.
3. Furnish reinforced cross bars for door over 40" wide.
4. Furnish rod and latch guards on all surface mounted vertical rod exit device, on bottom rods.
5. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.
6. For keyed removable mullion: Provide with cylinder to match building system.
7. Provide cylinder (or lever when specifed for security) dogging on all non-rated devices. Provide cylinder to match building system. Exit devices with electronic applications are to be supplied without any mechanical dogging unless specified in hardware sets.
8. Provide and install wiring from electric exit device to power supply.
9. Provide all aluminum door leafs with Mullion Stabilizers and Blade Stop Strikes.
10. Provide exit devices properly sized for door width and height.
11. Provide strike as recommended by manufacturer for application indicated.
12. Provide less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.
13. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.05 ELECTRIC STRIKES

A. Manufacturers:
1. Von Duprin, an Allegion brand; 6000 Series: www.allegion.com/us.
2. HES; an Assa Abloy Group company; 8000 Series: www.assaabloydss.com.

B. Provide Fail Secure mode.

C. Power Supply:
1. Standard input 120 VAC at 0.6 amps, 12/24VDC.
2. Provide battery backup.
3. Lockable cabinet.
4. Provide and install wiring from electric strike to power supply.

2.06 ELECTROMAGNETIC LOCKS

A. Manufacturers:
1. Schlage Electronics, an Allegion brand: www.allegion.com/us.
2. Securitron; an Assa Abloy Group company: www.assaabloydss.com.

B. Electromagnetic Locks: Comply with BHMA A156.23.

C. Double doors swinging in the same direction - without exposed vertical rod exit devices:
1. Schlage Electronics: Model M492P.
2. Securitron: Model M82 Series Magnalock.

D. Single doors and double doors with vertical rod exit devices and double egress doors:

1. Schlage Electronics: Model M420.
2. Securitron: Model M32 Series Magnalock.

E. Power Supply:
1. 120 Voltage: 2 amp @ 12/24 VDC.
2. Fire alarm interface board.
3. Battery back-up.
4. Lockable cabinet.
5. Provide and install wiring from electromagnetic locks to power supply.

F. Provide electromagnetic locks for fire-rated doors in compliance with UL 10C.

G. Mounting: Surface mounted to door and frame on secure side, with fasteners, brackets, and spacer bars as required for application.

H. Key Switches: Provide a SPDT maintained single direction with red/green LED indicator switch at each side of door. Provide a cylinder keyed to building system for each key switch.
1. Schlage: 650 Series Keyswitch.
2. Securitron: MK Mortise Keyswitch
3. Provide and install wiring from electromagnetic lock to switches.

I. Provide 1/8" thick white acrylic signs with 1" high red letters as follows:
1. To read: "THIS DOOR WILL UNLOCK UNDER EMERGENCY FIRE CONDITIONS." Install within 12 inches of panic hardware, door latching hardware or push plate.
2. To read: "PULL FOR EMERGENCY EXIT FIRE ALARM WILL SOUND". Install at fire alarm pull station on each side of door.

2.07 LOCK CYLINDERS

A. Manufacturers:
1. Corbin Russwin; an Assa Abloy Group company: www.assaabloydss.com.
2. Sargent; an Assa Abloy Group company: www.assaabloydss.com.
3. Yale; an Assa Abloy Group company: www.assaabloydss.com.
4. Schlage, an Allegion brand: www.allegion.com/us.
5. Falcon, an Allegion brand: www.allegion.com/us.
6. Best, dormakaba Group: www.bestaccess.com.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide cams and/or tailpieces as required for locking devices.

2.08 KEYING

A. Change key and masterkey all lock cylinders from the keying meeting.

B. Furnish two change keys for each lock, six masterkeys for each masterkey set, and two removable core control keys.

C. Stamp keys with file key number and "Do Not Copy."

D. Ship masterkeys and control keys to the Owner via registered mail.

E. Permanent cylinder cores shall be installed by the contractor under the supervision of an Owner's representative.

F. Rekey entire building including existing locks not scheduled. Contractor is required to visit the site and verify exact quantity and type of cylinders/cores required for re-keying. Additional compensation will not be allowed if the Contractor fails to field verify before the bid.

G. Construction key all exterior cylinders and supply six (6) construction master keys. Using building keys clears construction keying without removal of cylinders.

2.09 LOCKS

A. Manufacturers:
1. Mortise Locks:
a. Corbin Russwin; an Assa Abloy Group company; ML2000 LWA: www.assaabloydss.com.
b. Sargent; an Assa Abloy Group company; 8200 LNJ: www.assaabloydss.com.
c. Yale; an Assa Abloy Group company; 8700L CRR: www.assaabloydss.com.
d. Schlage, an Allegion brand; L9000 03A: www.allegion.com/us.
e. Falcon, an Allegion brand; M Series SG: www.allegion.com/us.
f. Best, dormakaba Group; 45H 3H: www.bestaccess.com.

2. Furnish lock types and functions specified in the hardware schedule, with the following provisions:
    a. Strikes:
        1) Wrought box type for the inactive leaf of pairs of wood doors, or wood frames.
        2) Lip length sufficient to protect trim, frame or inactive leaf.
3. Furnish knurled lock knobs or lever handles on doors to stairs other than exit stairs, loading platforms, stages, boiler rooms, and other hazardous locations.
4. Lever handles must be cast brass, bronze or stainless steel construction and conform to ASNI A117.1.
5. Provide and install wiring from electric lockset to power supply.

2.10 DOOR PULLS, PUSH PLATES/BARS AND FLUSH CUP PULLS

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com.
3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha.
4. Burns Manufacturing: www.burnsmfg.com.
5. Ives, an Allegion brand: www.allegion.com/us.

B. Door Pulls, Push Plates/Bars and Flush Cup Pulls:
1. Satin finished stainless steel.
2. Manufacturers and products:
    a. Pull-10"
        1) Burns: 26C.
        2) Hager: CTC-4J.
        3) Ives: 8103HD.
        4) Rockwood: 111.
    b. Push Plate for Flush Doors
        1) Burns: 57.
        2) Hager: 30s 8x16.
        3) Hiawatha: 200.
        4) IVES: 8200 8x16.
        5) Rockwood: 70F.
    c. Push Plate for 6 inch (152.4 mm) Stile Doors
        1) Burns: 54.
        2) Hager: 30s 4x16.
        3) Hiawatha: 200F.
        4) Ives: 8200 4x16.
        5) Rockwood: 70C.
    d. Pushbar
        1) Burns: 422.
        2) Hager: 130s.
        3) Ives: 9100HD
        4) Rockwood: 47.
    e. Flush Cup Pulls
        1) Hager: 27p
        2) Rockwood: BF97.

2.11 COORDINATORS

A. Manufacturers:
1. Hager Companies; 297D Series: www.hagerco.com.
2. Door Controls International; 600 Series: www.doorcontrols.com.
3. Rockwood; an Assa Abloy Group company; 1600 Series: www.assaabloydss.com.
4. Ives, an Allegion brand; COR Series: www.allegion.com/us.

B. Furnish coordinator for labeled pairs of doors equipped with automatic flush bolts or vertical rod-mortise lock fire exit device combinations with astragals.

C. Furnish filler bars for total opening width, closer mounting brackets, carry bars, and special preparation for top latches where applicable.

2.12 CLOSERS

A. Manufacturers; Surface Mounted:
   1. LCN, an Allegion brand; 4011/4111 EDA Series: www.allegion.com.
   2. Norton; an Assa Abloy Group company; 7500 Series: www.assaabloydss.com.
   3. Sargent; an Assa Abloy Group company; 281/281P10 Series: www.assaabloydss.com.
   4. Yale; an Assa Abloy Group company; 4400 Series: www.assaabloydss.com.
   5. LCN, an Allegion brand; 4011/4111 EDA Series: www.allegion.com/us.
   6. Stanley, dormakaba Group; D-4550 Series: www.stanleyhardwarefordoors.com.

B. Where closers are listed in the hardware schedule, furnish series listed above unless other functions/series are specified in the hardware groups.

C. Furnish complete with all mounting brackets, drop plates and special shoes as may be required by the door and frame conditions.

D. Determine closer size in accordance with manufacturer's recommendations for application on the room side of corridor doors, stair side of stair doors, and interior side of exterior doors.

E. Provide rust inhibitor primer for all closers in pools, toilet stalls, showers and other corrosive areas.

F. Furnish through bolt attachments for closers specified for wood doors.

2.13 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
   1. Rixson; an Assa Abloy Group company: www.assaabloydss.com.
   2. Glynn-Johnson, an Allegion brand: www.allegion.com/us.

B. Overhead Stop Manufacturers and Product
   1. Overhead Stops for Doors with Closers
      a. Use for all doors equipped with regular arm surface closers that swing more than 140 degrees before striking a wall.
      b. Glynn-Johnson: GJ90.
      c. Rixson: 9.
   2. Overhead Stops for Doors with Closers
      a. Use for all doors without CUSH closer that open against equipment, casework, sidelights or other objects that would make wall bumpers inappropriate.
      b. Glynn-Johnson: GJ450.
      c. Rixson: 10.
   3. Overhead Holders
      a. Glynn-Johnson: GJ90 or GJ 100 Series.
      b. Rixson: 9 or 1.
   4. Furnish sex bolt attachments for mineral core door applications, unless solid wood blocking is provided in the door for attachment.

2.14 KICK/ARMOR PLATES

A. Kick Plates: Where kick plates are specified in the Hardware Sets, furnish 16 gauge, 0.050 inch (1.27 mm) plates, with the following dimensions:
   1. Width: 2 inch (50.8 mm) less than door width.
   2. Height: 8 inch (203.2 mm) unless noted different in Hardware Sets.
   3. All kick plates shall be beveled 4 sides and counter sunk.

B. Armor Plates: Where armor plates are specified in the Hardware Sets, furnish 16 gauge, 0.050 inch (1.27mm) plates with the following dimensions:
   1. Width: 2 inch (50.8 mm) less than door width.
   2. Height: 34 inch (863.6 mm), unless noted different in Hardware Sets.
   3. All armor plates shall be beveled 4 sides and counter sunk.

2.15 FLOOR STOPS, WALL STOPS AND HOLDERS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
   2. Hager Companies: www.hagerco.com.
   3. Burns Manufacturing: www.burnsmfg.com.
   4. Ives, an Allegion brand: www.allegion.com/us.

5. Manufacturers and product
    a. Wall Bumper
        1) Burns: 570.
        2) Hager: 232W
        3) Ives: WS407CVX.
        4) Rockwood: 407.
    b. Wall Stop
        1) Burns: 530.
        2) Hager: 255
        3) Ives: WS11X.
        4) Rockwood: 475.
    c. Floor Stop
        1) Burns: 510/525.
        2) Hager: 241F/246B
        3) Ives: FS435/FS436.
        4) Rockwood: 441U.
6. Furnish a wall bumper, as applicable, for each door leaf unless where other model stops or overhead stops/holders are specified in the hardware schedule.
    a. Where wall stops are not applicable, furnish overhead stops as previously specified within this section of the specification.

2.16 THRESHOLDS, WEATHERSTRIPS AND JAMB GASKETS

A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
2. National Guard Products, Inc: www.ngpinc.com.
3. Reese Enterprises, Inc: www.reeseusa.com.
4. Zero International, Inc, an Allegion brand: www.allegion.com/us.
5. Manufacturers and Products
    a. Saddle Threshold
        1) National Guard: 425E.
        2) Pemko: 171A.
        3) Reese: S205A.
        4) Zero: 8655.
    b. Half Saddle Threshold
        1) National Guard: 325 Alum.
        2) Pemko: 229A.
        3) Reese: S245A.
        4) Zero: 1675.
    c. Bumper Seal Threshold
        1) National Guard: 896 Alum (Vinyl).
        2) Pemko: 2005AV.
        3) Reese: S483AV.
        4) Zero: 65A.
    d. Weatherstrip
        1) National Guard: 700NA.
        2) Pemko: 2891APK.
        3) Reese: 755A.
        4) Zero: 429.
    e. Astregal Weatherstrip
        1) National Guard: 185.
        2) Pemko: Pair 309.
        3) Reese: 804.
        4) Zero: 8193.
    f. Sweep with Rain Drip

1) National Guard: 101V.
2) Pemko: 345_PK.
3) Reese: 353.
4) Zero: 8197.

g. Head and Jamb Gasket
1) National Guard: 5050.
2) Pemko: S88.
3) Reese: 797.
4) Zero: 188.

h. Meeting Style Astregal
1) National Guard: 9605.
2) Pemko: 18061_NB (MS).
3) Reese: 804.
4) Zero: 8193.

i. Drip
1) National Guard: 16.
2) Pemko: 346.
3) Reese: R201.
4) Zero: 142.

j. Jamb Sound Seal
1) National Guard: 1038.
2) Pemko: 350CSR.
3) Reese: F499.
4) Zero: 770.

k. Auto Door Bottom
1) National Guard: 420.
2) Pemko: 430CPKL.
3) Reese: F521.
4) Zero: 361.

l. Mullion Seal
1) National Guard: 5100N.
2) Pemko: 5110.
3) Reese: 628.
4) Zero: 8780.

6. Where specified in the hardware groups, furnish the above products unless otherwise details in groups.
7. Furnish Head/Jamb Gaskets and Meeting Stile Astragals for pairs, at all fire labeled doors whether listed in group or not.
8. Coordinate with door manufacturer the intumescent fire and smoke material for fire rated openings as required by door and frame manufacturer to comply with UL 10C, UBC test 7-2.
9. When “threshold” appears within a hardware group provide the following:
   a. At aluminum entrances on new buildings provide a half saddle threshold.
   b. At aluminum entrances on existing buildings provide a saddle threshold.
   c. At interior door ways provide a saddle threshold.
   d. At exterior doorways from occupied rooms and HM or FRP exit only doors provide a bumper seal threshold.
   e. At exterior HM or FRP doors to receiving areas, loading docks and boiler rooms provide a saddle threshold.
10. When removable mullions are furnished provide the Mullion Seal application as listed above.

2.17 COAT HOOKS

A. Manufacturers:
1. Hager Companies; 940P: www.hagerco.com.
2. Ives; an Allegion brand; Ives 543 Camelot: www.us.allegion.com.
3. Rockwood; an Assa Abloy Group company; Rockwood RM828: www.assaabloydss.com.

B. Coat Hooks: Provide on room side of door, screw fastened.
C. Material: Stainless steel.

2.18 MISCELLANEOUS ITEMS

2.19 FINISHES

A. Finish and Base Metal

Butt Hinges- Exterior	US32D on stainless steel
Butt Hinges-Interior	US26D on steel
Flush Bolts	US26D on brass or bronze
Exit Devices	US26D on brass or bronze
Locks	US26D on brass or bronze
Pulls And Push Plates/Bars	US32S on stainless steel
Coordinators	USP on steel
Closers	Sprayed AL on cast iron or aluminum
Protective Plates	US32D on stainless Steel
Overhead Stops	US32D on stainless steel
Wall Stops	US26D on brass, bronze, or steel
Magnetic Holder	Powder Coated-Aluminum color
Thresholds	Mill aluminum
Weatherships and Sweep Strips	Clear anodized aluminum
Key Cabinets	Gray enamel on steel
Miscellaneous	US26D on brass or bronze

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
B. Coordinate electric power requirements with the Electrical Contractor on site and ensuring the proper power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware, including UL labeled openings, in accordance with manufacturer's instructions and applicable codes.
B. Use templates provided by hardware item manufacturer.
C. Do not install surface mounted items until application of finishes to substrate are fully completed.
D. Door Hardware Mounting Heights:
   1. Install hardware at mounting heights conforming to the recommended mounting locations of the Builders' Hardware Manufacturing Association, and the adopted Building Code.
   2. Install wall stops, wall holders, and magnetic holders to strike near top of doors, but not more than 78" from the finished floor line; install wall stops WS407CVX to engage knobs, levers or pulls.
   3. Install pulls at 36" to center of pull and push bars at 36" above finished floor. Off set pull on exterior door rails to allow access to cylinders in lieu of providing offset pulls.
E. Install closers on the room side of corridor doors, stair side of stairways, and interior side of exterior doors.
F. Deliver to the Owner one complete set of installation and adjustment instructions, and tools as furnished with the hardware.
G. Install hardware mountable weatherstipping on exterior doors, continuous throughout opening prior to installation of other hardware. Hardware mounted before weatherstripping will be rejected and require removal and re-installation.
H. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING AND INSPECTION

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
B. Adjust hardware for smooth operation, and Building Code compliance.
C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.
D. Panic Hardware device manufacturer's representative to inspect panic hardware installation and provide a written report to General Contractor or Construction Manager and Architect with a list of items that need correction.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative(s) to train Owner’s maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. At a minimum, provide the following training:

1. Miscellaneous hardware: 1 hour
2. Exit devices: 2 hours
3. Locks: 1 hour
4. Closers: 1 hour
5. Electromagnetic locks: 2 hours
6. Accessibility closers: 2 hours

B. Refer to Section 01 79 00 - Demonstration and Training.

END OF SECTION 08 71 00

SECTION 08 80 00
GLAZING

TURN OFF EXTERIOR GLAZING
TURN OFF FULL HEIGHT WALL MIRRORS
TURN OFF ONE WAY GLAZING
TURN OFF SECURITY LAMINATED & ATTACK/BURGLAR GLAZING
TURN OFF SITE CONSTRUCTED DISPLAY CASES
TURN OFF DETENTION GLAZING
TURN OFF SWITCHABLE PRIVACY GALZING
TURN OFF SMOKE DRAFT CURTAINS
TURN OFF SECURITY WINDOW FILM FOR EXISTING GLAZING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Interior Glazing
      a. Safety glass in locations identified in Part 3.
      b. Clear glass in HM doors and frames.
      c. Clear glass in wood doors.
      d. Full height wall mirrors.
      e. One-way glazing.
      f. Laminated translucent glazing.
      g. Site Constructed Display Cases including:
         1) Spandrel glass.
         2) Clear glass shelves, standards, brackets.
         3) Sliding glass tracks with clear glazing.
      h. Security laminated glazing.
      i. Laminated glass in doors and frames.
      j. Security window film on existing glazing.
      k. Detention Glazing.
      l. Switchable Privacy Glazing.
      m. Smoke Draft Curtains.
   2. Exterior Insulated Glazing
      a. Safety glass in locations identified in Part 3.
      b. Clear glass in aluminum doors.
      c. Clear glass in FRP doors.
      d. Clear glass in windows, storefront and curtainwall.
      e. Tinted glass in windows, storefront and curtainwall.
      f. Silk screened glass in windows, storefront and curtainwall.
      g. Reflective glass in windows, storefront and curtainwall.
      h. Spandrel glass in windows, storefront and curtainwall.
      i. Laminated glass in doors, windows, storefront and curtainwall.

1.02 QUALITY ASSURANCE

A. Reference Specification: Glazing Manual by Flat Glass Marketing Association.
B. Materials: Conform in all respects to the "Safety Standard for Architectural Glazing Materials" (16CFR 1201) issued by the Consumer Product Safety Commission and Chapter 24 of the International Building Code.
C. Insulating glass units to be CBA rated with the Insulating Glass Certification Council (IGCC) in accordance with ASTM Specifications E-773 and E-774.

1.03 SUBMITTALS

A. Submit per Section 01 30 00 - Administrative Requirements.
   1. Product data:
      a. Insulating glass units.
      b. Security glazing.

c. Mirrors.
d. Shelving components.
2. Samples for each type glass specified.
3. Sample warranties.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage.
B. Reject scratched glass.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Manufacturer Warranty: Provide five-year manufacturer warranty against failure of laminated glass products. Complete forms in Owner's name and register with manufacturer.
C. Manufacturer Warranty: Provide ten manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.
D. Security Film Manufacturer Warranty: Provide 15 year manufacturers commercial building warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS/FABRICATORS

A. Glass Manufacturers and/or Coating Manufacturers:
1. AGC Glass North America, Inc.: www.us.agc.com.
2. Cardinal Glass Industries: www.cardinalcorp.com.
3. Guardian Industries, LLC: www.sunguardglass.com.
4. Old Castle Building Products: www.oldcastlebe.com.
5. Pilkington North America, Inc.: www.pilkington.com.
6. Viracon, Inc.: www.viracon.com.
7. Vitro Architectural Glass: www.vitroglazings.com.

B. Fire Rated Glass Manufacturers:
1. SAFTI First, www.safti.com.
2. Technical Glass Products, www.fireglass.com.
3. Vetrotech Saint-Gobain, www.vetrotechusa.com.
4. McGrory Glass, www.mcgrory.com.

C. Security Glass Manufacturers:
1. School Guard Glass (SGG), www.schoolguardglass.com.
2. Global Security Glazing, www.security-glazing.com;
3. Old Castle Building Products, www.oldcastlebe.com;
4. McGrory Glass, www.mcgrory.com;

D. Attack/Burglar Glass Manufacturers:
1. Global Security Glazing, www.security-glazing.com;
2. Old Castle Building Products, www.oldcastlebe.com;
3. McGrory Glass, www.mcgrory.com;

E. Detention Glazing Manufacturers:
1. Advanced Impact Technologies, www.advanced-impact.com.
2. Global Security Glazing, www.security-glazing.com;
3. McGrory Glass, www.mcgrory.com.
4. Old Castle Building Products, www.oldcastlebe.com;

F. Switchable Privacy Glazing Manufacturers:
1. Polytronix, Inc: www.polytronixglass.com.
2. Equivelant products by other manufacturers are acceptable.

G. Interlayer Manufacturers: Vanceva, www.vanceva.com, or equal.
H. Security Window Film Manufacturers: 3M, www.3m.com.
I. Glass Product Fabricators: As certified by glass manufacturers and/or coating manufacturers.

2.02 INTERIOR GLAZING

A. Clear:
1. Clear Float Glass, ¼ inch (6.35 mm) thick.

2. Clear Float Glass, 1/2 inch (12.7 mm) thick [for panes 72 inches (1828.8 and higher].

B. Safety:
1. Clear heat-tempered float glass, ¼ inch (6.35 mm) thick.
2. Clear Float Glass, 1/2 inch (12.7 mm) thick [for panes 72 inches (1828.8 and higher].
3. Laminated glass, 5/16 inch (7.9375 mm) thick, consisting of 1/8 inch (3.175 mm) thick heat-tempered float glass, interlayer of 0.030 inch (0.762 mm) thick clear Poly Vinyl Butyral (PVB), 1/8 inch (3.125 mm) thick heat-tempered float glass.
4. Athletic facility laminated glass 9/16 inch (14.2875 mm) thick consisting of 1/8 inch (3.175 mm) thick heat-tempered float glass, interlayer of 0.060 inch (1.524 mm) thick clear Poly Vinyl Butyral (PVB), ¼ inch (6.35 mm) thick heat tempered float glass.
5. Draft Curtain Glazing: Heat-tempered float glass, 1/2 inch (12.7 mm) thick.

C. Security:
1. Security Laminated Glazing with a 10 Minute Duration, complying with one of the following tests: HPW TP-0500, Level 1 Forced Entry – Level A Ballistics; ASTM F1233 Class 1.4 (1/2 bite in frame); UL 972; ASTM F1915 or HP White 5-aal.
    a. Alternate products to the ones specified below will need to provide a current HP White 5-aal or similar test that indicates at least 5 shots with a 7.62 mm round and then a 10 minute duration attack without failure.
        1) School Guard Glass: SG5, 7/16 inch (11.1125 mm) thick.
        2) Global Security: Childguard, 9/16 inch (14.2875 mm) thick.
        3) McGrory Glass: DefendED Plus, 7/16 inch (11.1125 mm) thick.
        4) OBE: Armor Protect Plus #121100, 9/16 inch (14.285 mm) thick.
2. Banded Security Laminated Glazing:
    a. 15/16 inch (23.8125 mm) thick glazing consisting of:
        1) 3/8 inch (9.525 mm) tempered glass.
        2) School Guard Glass propritary interlayer.
        3) 3/8 inch (9.525 mm) tempered glass.
    b. Horizontal edges, polished.
3. Security Window Film:
    a. Optically clear micro-layered polyester film, with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is clear and will not contain dyed polyester. Film contains at least forty-two micro-layers.
        1) 3M Ultra S600.
            (a) Physical / Mechanical Performance Properties:
            (b) Film Color: Clear.
                (1) Visible Light Transmittance: 50%.
            (c) Thickness: Nominal 7.992 mil (0.22 mm), comprised of 42 micro-layers.
            (d) Tensile Strength (ASTM D 882): 27,000 psi (186 MPa).
            (e) Break Strength (ASTM D 882) (Per Inch Width): 215 lbs/in (956 N/25mm).
            (f) Tear Resistance (ASTM D 1004): Greater than 1,100 lbs%.
            (g) Impact Resistance for Safety Glazing: Tested on 1/4 inch (6.4 mm) annealed glass.
                (1) Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
            (h) Safety Rating (ANSI Z97.1): Class A, Unlimited Size.
            (i) Attachment system: 3M Impact Protection Attachment System.
                (1) Color: Black.
4. Attack/Burglar Resistant Glazing:
    a. Clear (AG-20) Glass Clad Polycarbonate with minimum 20 Minute Duration, complying with one of the following tests: HPW TP-0500.03, Level B Ballistics; ASTM F-1915 Grade 3 (20 minutes of physical attack).
        1) Basis of Design: McGrory Glass: AttackDefend 20, 3/4 inch (19.05 mm) nominal thickness.
        2) Equivalent products by Global Security Glazing and Oldcastle Building Envelope are acceptable.

b. Clear (AG-40) Glass Clad Polycarbonate with minimum 30 Minute Duration, complying with one of the following tests: HPW TP-0500.03, Level II Forced Entry and Level B Ballistics; ASTM F-1233 Class 3.2.
   1) McGrory Glass: AttackDefend 40, 13/16 inch (20.64 mm) nominal thickness.
   2) Equivalent products by Global Security Glazing and Oldcastle Building Envelope are acceptable.
c. Clear (AG-60) 60 Minute Duration, complying with one of the following test: HPW TP-0500.03, Level C Ballistics; ASTM F-1915 Grade 1 (60 minutes of physical attack).
   1) McGrory Glass: AttackDefend 60-Plus, 1-7/32 inch (30.96 mm) nominal thickness.
   2) Equivalent products by Global Security Glazing and Oldcastle Building Envelope are acceptable.

D. Detention Glazing, Single Glazed, complying with the following:
1. Manufacturers:
   a. Advanced Impact Technologies, www.advanced-impact.com.
   b. Global Security Glazing, www.security-glazing.com;
   c. McGrory Glass, www.mcgrory.com.
   d. Old Castle Building Products, www.oldcastlebe.com;
2. Clear (DG-1) Glass Clad Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 1; 9 mm Full Metal Copper Jacket with Lead Core; No Spall, No Penetration.
3. Clear (DG-2) Glass Clad Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 2; .357 Magnum Jacketed Lead Soft Point; No Spall, No Penetration.
4. Clear (DG-3) Glass Clad Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 3; .44 Magnum Lead Semi-Wadcutter Gas Checked; No Spall, No Penetration.
5. Clear (DG-4) Glass Clad Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 4; .30 Caliber Rifle Lead Core Soft Point; No Spall, No Penetration.
6. Clear (DG-5) Glass Clad Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 5; 7.62 mm Rifle Lead Core Full Metal Copper Jacket Military Ball (.308 Caliber) One (1) Shot; No Spall, No Penetration.
7. Clear (DG-6) Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 6; 9 mm Uzi Full Metal Copper Jacket with Lead Core; No Spall, No Penetration.
8. Clear (DG-7) Glass Clad Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 7; 5.56 mm Rifle Full Metal Copper Jacket with Lead Core; No Spall, No Penetration.
9. Clear (DG-8) Glass Clad Polycarbonate:
   a. Ballistics Performance Testing: UL 752 Level 8; 7.62 mm Rifle Lead Core Full Metal Copper Jacket Military Ball (.308 Caliber) Five (5) Shots; No Spall, No Penetration.

E. Switchable Privacy Glazing (LCD):
1. Polytronix: Polyvision PDLC Switchable Privacy Glass, clear annealed, heat or chemically strengthened or tempered glass, laminated glass with two layers of transparent conductive film sandwiched with PDLC material to create a switchable film.
   a. Power requirements: 110V AC, 60 Hz.
   b. Provide power supplies, appropriate door and window packages.

F. Fire Rated:
1. Square pattern clear wire glass, ¼ inch (6.35 mm) thick, conforming to CPSC 16 CFR 1201, CAT II and tested by UL or Intertek Warnock/Hersey.
2. Non-wire glass products with a fire rating to match opening schedule on the drawings by one of the following are acceptable:
   a. McGrory Glass

b. SAFTI First.
c. Technical Glass Products.
d. Vetrotech Saint-Gobain.

G. Reflective
1. Wall mirror, ¼ inch (6.35 mm) thick, Mirror Select Quality". Fully adhered to wall with adhesive recommended by glass fabricator.
a. Provide height as shown on drawings and total width of wall.
2. One-way insulated:
a. 1 inch (25.4 mm) thick, or similar products by other specified manufacturers:
1) Outboard lite of ¼ inch (6.35 mm) Guardian SunGuard Silver 20 on surface #2.
2) ½ inch (12.7 mm) airspace-mill finish.
3) Inboard lite of ¼ inch (6.35 mm) Guardian SunGuard MidnightGray.
b. Reflectance out: 30%.
c. Reflectance in: 4%.

H. Translucent/Opaque
1. Spandrel, ¼ inch (6.35 mm) thick, painted with foil backing.
a. Color: _____.
2. Laminated translucent, 5/16 inch (7.9375 mm) thick, consisting of 1/8 inch (3.175 mm) tempered float glass, interlayer of Vancera Poly Vinyl Butyral (PVB) 0.030 inch (0.762 mm) thick, 1/8 inch (3.175 mm) tempered float glass.
a. PVB Color: _____.

I. Glass Shelves
1. Clear Fully Tempered Float Glass, 1/4 inch (6.35 mm) thick.
2. Ground edges and corners.
3. Holes for cable supports.

2.03 EXTERIOR GLAZING

A. Low-E glass to be solar control (MSVD coating process).
B. For fire rated glazing, substitute appropriate lites with Fire Rated Glazing as specified under interior glazing.
C. For locations requiring safety glazing, provide heat-tempered glass for inboard and outboard lites, unless laminated glazing is called out on drawings or specified.
D. ***SPECIFIER NOTE: Below is a sample of clear glass.***
E. Clear Insulated Glass: (Type EC1).
1. 1 inch (25.4 mm) overall thickness insulated glass.
a. Exterior glass ply/coating:
1) ¼ inch (6.35 mm) clear with:
(a) Vitro Solarban 60.
(b) Guardian SN68.
(c) AGC Energy Select 40.
(d) Similar products by other specified glass/coating manufacturers.
2) Low-E on Surface #2.
b. Spacer: Warm edge.
c. Airspace: ½ inch (12.7 mm) argon filled.
d. Silicone: Black.
e. Interior glass ply: ¼ inch (6.35 mm) clear.
2. Performance Requirements:
a. Transmittance:
1) Visible light: 70%.
b. Reflectance:
1) Visible Light Exterior: 11%.
2) Visible Light Interior: 12%.
c. ASHRAE U-Value:
1) Winter Nighttime: 0.24 BTU.
d. Solar Heat Gain Factor (SHGC): 0.39

e. LSG: 1.79.

3. For units requiring “Safety Glazing” per Part 3 of Specification, provide “safety” glass plys. Specified under interior glazing.
4. For locations indicated for spandrel, provide ceramic frits on surface #4.
   a. Color: _____.

F. Clear Insulated Glass: (Type EC2).
1. 1 inch (25.4 mm) overall thickness insulated glass.
   a. Exterior glass ply/coating:
      1) ¼ inch (6.35 mm) clear with:
         (a) Vitro Clear Solarban R100 Optiblue.
         (b) Guardian SNR43 on Crystal Blue.
         (c) Similar products by other specified glass/coating manufacturers.
      2) Low-E on Surface #2.
   b. Spacer: Warm edge.
   c. Airspace: ½ inch (12.7 mm) argon filled.
   d. Silicone: Black.
   e. Interior glass ply: ¼ inch (6.35 mm) clear.
2. Performance Requirements:
   a. Transmittance:
      1) Visible light: 30%.
   b. Reflectance:
      1) Visible Light Exterior: 19%.
      2) Visible Light Interior: 13%.
   c. ASHRAE U-Value:
      1) Winter Nighttime: 0.25 BTU.
   d. Solar Heat Gain Factor (SHGC): 0.19.
   e. LSG: 1.58.
3. For units requiring “Safety Glazing” per Part 3 of Specification, provide “safety” glass plys. Specified under interior glazing.
4. For locations indicated for spandrel, provide ceramic frits on surface #4.
   a. Color: _____.

G. Laminated Insulated Glass: (Type ECL1).
1. 1 ¼ inch (31.75 mm) overall thickness laminated insulated glass.
   a. Exterior glass ply/coating:
      1) ¼ inch (6.35 mm) clear with:
         (a) Vitro Solarban 60.
         (b) Guardian SN68.
         (c) AGC Energy Select 40.
      2) Low-E on Surface #2.
   b. Spacer: Warm edge.
   c. Airspace: 7/16 inch (11.1125 mm) argon filled.
   d. Silicone: Black.
   e. Interior glass ply:
      1) ¼ inch (6.35 mm) clear.
      2) 0.030" clear PVB.
      3) ¼ inch (6.35 mm) clear.
2. Performance Requirements:
   a. Transmittance
      1) Visible light: 68%.
   b. Reflectance
      1) Visible Light Exterior: 11%.
      2) Visible Light Interior: 12%.
   c. ASHRAE U-Value:

1) Winter nighttime: 0.24 BTU.
d. Solar Heat Gain Factor (SHGC): 0.38.
e. LSG: 1.79.
3. For units requiring “Safety Glazing” per Part 3 of Specification, provide “safety” glass plys. Specified under interior glazing.
4. For locations indicated for spandrel, provide ceramic frits on surface #4.
a. Color: _____.

H. Security Laminated Insulated Glass: (Type ESL #1).
1. 1 inch (25.4 mm) or 1 ¼ inch (31.75 mm) overall thickness laminated insulated glass
2. Exterior glass ply/coating:
a. ¼ inch (6.35 mm) clear with:
1) Vitro Solarban 60.
2) Guardian SN68.
3) AGC Energy Select 40.
4) Similar products by other specified glass/coating manufacturers.
b. Low-E on Surface #2.
3. Spacer: Warm edge.
4. Airspace: 7/16 inch (11.1125 argon filled.
5. Silicone: Black.
6. Interior glass ply:
a. Security glazing consisting of one of the following:
1) School Guard Glass SGG5, 5/16 inch (7.9375 mm) thick.
2) Global Security Childguard, 9/16 inch (14.2875) thick.
3) McGrory Glass: DefendED Plus, 9/16 inch (14.2875 mm) thick.
4) OBE, Armor Protect Plus #121100, 9/16 inch (14.2875) thick.
7. Performance Requirements:
8. Transmittance:
a. Visible light: 68%.
9. Reflectance:
a. Visible Light Exterior: 11%.
b. Visible Light Interior: 12%.
10. ASHRAE U-Value:
a. Winter Nighttime: 0.24 BTU.
11. Solar Heat Gain Factor (SHGC): 0.38.
12. LSG: 1.79.
13. For units requiring “Safety Glazing” per Part 3 of Specification, provide “safety” glass plys. Specified under interior glazing.
14. For locations indicated for spandrel, provide ceramic frits on surface #4.
a. Color: _____.

I. Translucent/Opaque Insulated Glass: (type ET1 or EO1).
1. 1 inch (25.4 mm) overall thickness silk screened (dots) insulated glass.
a. Exterior glass ply/coating:
1) ¼ inch (6.35 mm) clear with:
(a) Vitro Solarban 60.
(b) Guardian SN68.
(c) AGC Energy Select 40.
(d) Similar products by other specified glass/coating manufacturers.
2) Low-E on Surface #2.
b. Spacer: Warm edge.
c. Airspace: ½ inch (12.7 mm) argon filled.
d. Silicone: Black.
e. Interior glass ply:
1) ¼ inch (6.35 mm) clear.

2) 40% coverage frit pattern on Surface #3.
f. Performance Requirements:
g. Transmittance
1) Visible light: 54%.
h. Reflectance:
1) Visible Light Exterior: 21%.
2) Visible Light Interior: 18%.
i. ASHRAE U-Value:
1) Winter Nighttime: 0.24 BTU.
j. Solar Heat Gain Factor (SHGC): 0.33.
k. LSG: 1.64.
l. For units requiring "Safety Glazing" per Part 3 of Specification, provide "safety" glass plys. Specified under interior glazing.
m. For locations indicated for spandrel, provide ceramic frits on surface #4.
1) Color: _____.

J. Tinted Insulated Glass (Type ET1).
1. 1 inch (25.4 mm overall thickness insulated glass.
a. Exterior glass ply/coating:
1) ¼ inch (6.35 mm) clear with:
(a) Vitro Atlantica Solarban 60.
(b) Guardian SuperNatural 68 on Twilight Green.
(c) AGC Energy Select 25.
(d) Similar products by other specified glass/coating manufacturers.
2) Low-E on Surface #2.
b. Spacer: Warm edge.
c. Airspace: ½ inch (12.7 mm) argon filled.
d. Silicone: Black.
e. Interior glass ply: ¼ inch (6.35 mm) clear.
f. Performance Requirements:
g. Transmittance:
1) Visible light: 53%.
h. Reflectance:
1) Visible Light Exterior: 8%.
2) Visible Light Interior: 11%.
i. ASHRAE U-Value:
1) Winter Nighttime: 0.23 BTU.
j. Solar Heat Gain Factor (SHGC): 0.26.
k. LSG: 2.04.
l. For units requiring "Safety Glazing" per Part 3 of Specification, provide "safety" glass plys. Specified under interior glazing.
m. For locations indicated for spandrel, provide ceramic frits on surface #4.
1) Color: _____.

K. Reflective Insulated Glass (Type ER1).
1. 1 inch (25.4 mm) overall thickness [stainless steel] reflective insulated glass.
2. Exterior glass ply/coating:
a. ¼ inch (6.35 mm) clear with:
1) Vitro Solarban R100 Clear.
2) Guardian SNR43 on Clear.
3) AGC Stopray Vision 36T on Clear.
4) Similar products by other specified glass/coating manufacturers.
b. Low-E on Surface #2.
3. Spacer: Warm edge.
4. Airspace: ½ inch (12.7 mm) argon filled.

5. Silicone: Black.
6. Interior glass ply: ¼ inch (6.35 mm) clear.
7. Performance Requirements:
8. Transmittance:
    a. Visible light: 8%.
9. Reflectance:
    a. Visible Light Exterior: 42%.
    b. Visible Light Interior: 38%.
10. ASHRAE U-Value:
    a. Winter Nighttime: 0.35 BTU.
11. Solar Heat Gain Factor (SHGC): 0.13.
12. LSG: 0.58.
13. For units requiring "Safety Glazing" per Part 3 of Specification, provide "safety" glass plys. Specified under interior glazing.
14. For locations indicated for spandrel, provide ceramic frits on surface #4.
    a. Color: _____.

L. Single Pane Spandrel: (Type SPS1).
1. Clear Float Glass, ¼ inch (6.35 mm) thick, painted on surface #2 with 2 inch (50.8 mm) foil backed rigid fiberglass insulation adhered to painted surface. Sealed to framing with silicone to proved a vapor barrier.
    a. Color: _____.

2.04 ACCESSORIES

A. Glazing Sealant: Two-part silicone similar to Dow Corning 982 Insulating Glass Sealant. Glazer is responsible to verify compatibility to primary seal material.
B. Setting Blocks: 100% silicone, 85+/- 5 Shore "A" durometer, located and sized to accommodate the requirements of the glazing fabricator, and compatible with glazing sealant.
C. Spacers: Warm edge thermal plastic.
D. Primer - Sealers, Cleaners: As recommended by glass manufacturer.
E. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
F. Sliding Glass Door Assembly: Stylmark, Inc.; www.stylmark.com or equal.
1. Model #610185.
    a. For ¼ inch (6.35 mm) glass panels up to 80 pounds (36.2873896 kg) .
    b. Includes the following parts: Tracks, retainers, shoes, wheel assemblies, top moldings, door guides, channels, jambs, bumpers, end caps and lock assembly.
G. Steel Standard Brackets for Site Constructed Display Case: Knape and Vogt; www.knapeandvogt.com or equal.
1. Standards: #87.
2. Brackets: #186/187.
3. Shelf Rests: #210/211/212.
4. Rubber Cushion Rests: #129.
H. Cable Display System: Grip Lock Systems, www.griplocksystem.com, or equal.
1. Cable: 3/32 inch (.38125 mm) stainless steel aircraft cable with a safe working load of 130 pounds (58.967008 kg).
2. Fittings:
    a. Glider with anchor plate: #DG-25-APLT-SAT.
    b. Glider with base plate: #DG-25-SAT.
    c. Double sided universal glider clamp: #DG-25-SCUX2-SAT.
    d. Single sided universal glider clamp: #DG-25-SCU-SAT.
    e. Material/Finish: Satin chrome plated brass.
3. Provide a complete system with all necessary parts / fittings.
I. Draft Curtain Hardware and accessories:

1. C.R. Laurence Co; CRL B5Bxx Continuous Smoke Baffle System designed for ½ inch (12.7 mm) thick tempered glass.
    a. 1-17/32 inch (38.9 mm) w x 2-51/64 inch (71 mm) high x 120 inch (3048 mm) long.
    b. Finish:
        1) Mill Finish Aluminum.
        2) Oil Rubbed Bronze Cladding.
        3) Dark Bronze Cladding.
        4) Polished Brass Cladding.
        5) Custom painted Cladding:
            (a) Color: _____.
    c. Sealant for Glazing Butt Joints: Silicone.

PART 3 EXECUTION

3.01 INSPECTION

A. Check that glazing channels are free of burrs, irregularities, and debris.
B. Check that glass is free of edge damage or face imperfections.
C. Do not proceed with installation until conditions are satisfactory.

3.02 PREPARATION

A. Field Measurements:
    1. Measure size of frame to receive glass.
    2. Compute actual glass size, allowing for edge clearances.
B. Preparation of Surfaces:
    1. Remove protective coatings from surfaces to be glazed.
    2. Clean glass and glazing surfaces, to remove dust, oil and contaminants. Wipe dry.

3.03 SAFETY GLAZING

A. Install safety glazing at the following locations and/or as required by local building codes.
    1. Doors and adjacent glazing:
        a. In doors when glass is wider than 2-15/16 inch (74.6125 mm) .
        b. Glass within 24 inch (609.6 mm) of vertical door edges and to a point 60 inch (1524 mm) above the floor.
    2. Individual fixed or operable panels when any of the following conditions are met:
        a. Individual panes 9 square feet (0.836127 square meter) and greater.
        b. Glass within 18 inch (457.2 mm) of the floor.
        c. When exposed individual pane is greater than 36 inch (914.4 mm) above the floor, except when a horizontal mullion is detailed between 34 inch (863.6 mm) and 38 inch (965.2 mm) above the floor.
        d. Walking surfaces within 36 inches (914.4 mm) horizontally of the pane of glazing.
    3. Stairs, landings and ramps:
        a. In guards or railings adjacent to stairs, landings and ramps.
        b. Glazing adjacent to stairways, landings and ramps within 36 inch (914.4 mm) horizontally of walking surface and less than 60 inch (1524 mm) above pane of adjacent walking surface.
        c. Glazing adjacent to bottom tread of stairways within 60 inch (1524 mm) horizontally and less than 60 inch (1524 mm) above the nose of the tread, unless the glass is protected by a guardrail and the glass is greater than 18 inch (457.2 mm) of the guardrail.
    4. Athletic facilities.
        a. Glazing in gymnasiums, swimming pools, multi-purpose athletic rooms. (Use athletic facility laminated glass).
        b. Wall mirrors in multi-purpose athletic rooms.

3.04 INSTALLATION

A. Install glass in accordance with glass manufacturer's current printed instructions.
B. Install sliding glass doors in accordance with manufacturer's instructions and as shown on Drawings.
C. Install security window film with the manufacturers impact protection attachment system bonding the film to the frame per the manufacturer's instructions.

3.05 CLEANING

A. Remove excess glazing compound from installed glass.
B. Remove labels from glass surface as soon as installed.
C. Wash and polish both faces of glass.
D. Remove debris from work site.

3.06 PROTECTION OF COMPLETED WORK

A. Attach crossed streamers away from glass face.
B. Do not apply markers to glass surface.
C. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08 80 00

SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum exterior wall louvers, frames and accessories.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials, including material thicknesses and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:

1. Products specified are by Ruskin: www.ruskin.com.
2. Equivalent products by other manufacturers are acceptable.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf (of 1.2 kPa) without damage or permanent deformation.
2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
4. Screens: Provide bird screens at intake and exhaust louvers.

B. Stationary Louvers: Model ELF 445DX; Horizontal blade, extruded aluminum construction, with concealed intermediate mullions, up to 120 inches (3,048 mm).

1. Free Area: 50 percent, minimum.
2. Blades: Drainable.
3. Frame: 4 inches deep (100 mm deep), channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
4. Aluminum Thickness: Frame 12 gauge, 0.0808 inch (2.05 mm) minimum; blades 12 gauge, 0.0808 inch (2.05 mm) minimum.
5. Aluminum Finish:
   a. Fluoropolymer resin powder coating in compliance with AAMA 2605.
      1) Color to match material louver occurs in.
      2) Color: _____
      3) Color as selected from manufacturers standard line.
   b. Mill Finish.
   c. Class I Natural Anodized.
   d. Class I Color Anodized: _____

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063-T6 or 6063-T5.

2.04 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

2.05 ACCESSORIES

A. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.

B. Fasteners and Anchors: Galvanized steel.

C. Flashings and Sill Flashing: Of same material as louver frame, formed to required shape, single length in one piece per location.

D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Set sill members and sill flashing in continuous bead of sealant.

D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

E. Secure louver frames in openings with concealed fasteners.

F. Coordinate with installation of mechanical ductwork.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION 08 91 00

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.
   4. Grinding or leveling of floors if required to meet floor flatness requirements.
   5. Including the following Specification Sections:
      a. 09 30 00 Tile.
      b. 09 65 00 Resilient Flooring.
      c. 09 68 13 Carpet Flooring.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Patching compound.

E. Epoxy Moisture Mitigation System over existing slab on grade, unless a breathable flooring is being installed.

F. Section 03 30 13 - Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

G. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.

H. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete 2020.

I. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2018.

1.02 SUBMITTALS

A. Submittals are referenced in the Flooring Specifications.

B. Visual Observation Report: For existing floor coverings to be removed.

C. Product Data: Substrate preparation materials.

D. Epoxy Moisture Mitigation System Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement for training of Installer.
   2. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.03 QUALITY ASSURANCE

A. Epoxy Moisture Mitigation Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.04 CONCRETE MOISTURE AND ADHESION

A. For new concrete slabs on grade, this project is utilizing a Porosity Inhibiting Admixture (PIA) as specified in Section 03 30 13.
   1. The PIA manufacturer will perform all moisture testing of new slabs on grade. No further field slab moisture or pH testing shall be required by the flooring installer. Probe type moisture tests will not provide accurate results with concrete that has PIA admixture, as the moisture remains irremovable and suspended within the slab.
   2. The flooring installer is to perform a field bond test with the specified flooring products and the flooring manufacturer’s recommended adhesive for non-porous substrates, with the PIA manufacturer’s representative present. The bond test shall be performed to adhesive manufacturer’s guidelines and ASTM F710.
   3. At completion of testing and prior to the installation of any flooring, the PIA manufacturer will issue the following warranties/guarantees:

4. Life of Concrete Warranty that states the PIA products ability to stop moisture vapor emission from the concrete itself for the life of the concrete.
    a. Up to 25 pounds of moisture per ASTM F1869 or 100% RH per ASTM F2170.
    b. Adhesion Guarantee stating the PIA manufacturer will guarantee and warrant that the materials bond tested will adequately bond directly to the PIA dosed concrete.

1.05 FLOOR FLATNESS

A. For new concrete slabs on grade and elevated structural slabs/topping as specified in Section 03 30 13 floor flatness is specified per ACI 117 as follows:
    1. For floors requiring a "moderately flat tolerance" (typically carpet):
        a. F (F) Flat tolerance with an overall value of 25 and a minimum localized value of 15.
        b. F (L) Flat tolerance with an overall value of 20 and a minimum localized value of 12.
        c. Measured by a manual straightedge method a “flat” floor surface classification, maximum gap for 90% compliance, samples not to exceed 3/8 inch (9.53 mm) and for 100% compliance, samples not to exceed 5/8 inch (15.88 mm).
    2. For floors requiring a "flat or greater tolerance" [typically resilient, vinyl tile, and thin-set ceramic/porcelain tile up to 16 inches (406 mm) in size without mortar beds and finishes with greater tolerances of resilient athletic flooring and thin-set ceramic/porcelain tile over 16 inches (406 mm) in size without mortar beds]:
        a. F (F) Flat tolerance with an overall value of 35 and a minimum localized value of 21.
        b. F (L) Flat tolerance with an overall value of 25 and a minimum localized value of 15.
        c. Measured by a manual straightedge method a “flat” floor surface classification, maximum gap for 90% compliance, samples not to exceed ¼ inch (6.35 mm) and for 100% compliance, samples not to exceed 3/8 inch (9.53 mm).
B. The flooring contractor will be responsible to provide the necessary means (i.e., grinding/leveling) for additional leveling as required by the flooring manufacturer.
C. The flooring contractor will be responsible to provide the necessary means (i.e., grinding/leveling) for leveling as required by the flooring manufacturer for existing concrete floor substrates as follows:
    1. On remodeling projects, assume 33% of area will require filling, or leveling up to 1/4 inch (6.35 mm) in height.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.
B. Deliver materials in manufacturer’s packaging; include installation instructions.
C. Keep materials from freezing.

1.07 WARRANTY

A. Moisture Control system need to reduce moisture emissions coming from concrete slab to a rate slow enough that the flooring system – adhesive and floor covering will not be affected.
    1. 20-year manufacturer material and labor warranty.

PART 2 PRODUCTS

2.01 MATERIALS

A. Substrate Prep and Patching:
    1. Patching Compound/Subfloor Filler:
        a. Self-drying cementitious moisture-, mildew-, and alkali-resistant compound, capable of being feathered to nothing at edges.
        b. Compressive Strength: 3000 psi, (210.92 kg/cm2), after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
        c. Thickness: Up to 1/2 inch (12.7 mm).
        d. VOC: 0 g/L.
        e. Products:
            1) ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com.
            2) Equivalent products by other manufacturers are acceptable.
    2. Crack and Joint Treatment:
        a. Dormant Cracks and Sawcuts: Two part, low viscosity, rigid polyurethane.

1) Tensile Strength: 4,150 psi (28.6 N/sq.mm), minimum, after 28 days, when tested in accordance with ASTM 638.
2) Elongation: 6% when tested in accordance with ASTM 638.
3) Die C Tear: 243 pli (425.5 N/cm) when tested in accordance with ASTM 624.
4) VOC: 0 g/L.
5) Thickness: No limits.
6) Products:
(a) ARDEX Engineered Cements; ARDEX Ardifix: www.ardexamericas.com.
(b) Equivalent products by other manufacturers are acceptable.

b. Moving Joints and Cracks: Two part, self leveling, semi-rigid polyurea fast setting joint sealant.
1) Tensile Strength: Approx. 1,200 psi (0.08 N/sq. m), when tested in accordance with ASTM D412.
2) Elongation: 82% when tested in accordance with ASTM D412.
3) Bond Strength: 400 psi (2.76 N/sq. m), when tested in accordance with ASTM C882.
4) VOC: 8 g/L.
5) Thickness: 1/4 to 2 inches (6.35 to 50.8 mm).
6) Products:
(a) ARDEX Engineered Cements; ARDEX Ardiseal Rapid Plus: www.ardexamericas.com.
(b) Equivalent products by other manufacturers are acceptable.

3. Substrate Prep: Rapid drying moisture resistant patch of portland and other hydraulic cements, trowel grade underlayment.
a. Moisture Tolerance: 100% RH.
b. VOC: 0 g/L.
c. Products:
1) ARDEX Engineered Cements; ARDEX MRF: www.ardexamericas.com.
2) Equivalent products by other manufacturers are acceptable.

4. Self Leveling Topping/Underlayment: Polymer blended portland cement based, self leveling topping.
a. Primer as recommended by manufacturer.
b. Compressive Strength: 5000 psi (351.53kg/cm2) after 28 days, when tested in accordance with ASTM C109/C109M.
c. Flexural Strength: 1,200 psi (84 kg/cm2) at 28 days, when tested in accordance with ASTM C348.
d. VOC: 0 g/L.
e. Thickness: 1/8 to 1-1/2 inch (3.175-38.1 mm).
f. Products:
1) ARDEX Engineered Cements; ARDEX K15: www.ardexamericas.com.
2) Equivalent products by other manufacturers are acceptable.

B. Epoxy Moisture Mitigation System: 100% solids, single coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Epoxy Moisture Control System:
a. Permeability: <0.10 perms, when tested in accordance with ASTM E96.
b. RH Readings: Up to 100%.
c. 14 pH solution: No effect, when tested in accordance with ASTM D1308.
d. VOC: 19.9 g/L, A+B, when tested in accordance with ASTM D2369.
e. Thickness: As required for application and in accordance with manufacturer's installation instructions.
f. Crack Repair: Products as recommended by manufacturer.
g. Products:
1) ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com.
2) HPS North America/Schonox; EPA Rapid: www.hpsubfloors.com

2. Hydraulic Cement-based self leveling topping:

a. Primer as recommended by manufacturer.
b. Compressive Strength: 5000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.
c. Flexural Strength: 1,200 psi (84 kg/cm2) at 28 days, when tested in accordance with ASTM C348.
d. VOC: 0 g/L.
e. Thickness: As required for application and in accordance with manufacturer's installation instructions.
f. Products:
1) ARDEX Engineered Cements; ARDEX K15: www.ardexamericas.com.
2) HPS North America/Schonox; SCHONOX ZM: www.hpsubfloors.com

3. Concrete topping for epoxy terrazzo, self leveling, self drying:
a. Primer as recommended by manufacturer.
b. Compressive Strength: 6100 psi (428 kg/cm2), after 28 days, when tested in accordance with ASTM C109/C109M.
c. Flexural Strength: 1,200 psi (84 kg/cm2) at 28 days, when tested in accordance with ASTM C348.
d. VOC: 0 g/L.
e. Thickness: As required for application and in accordance with manufacturer's installation instructions.
f. Products:
1) ARDEX Engineered Cements; ARDEX SD-T: www.ardexamericas.com.
2) HPS North America/Schonox; SCHONOX DSP: www.hpsubfloors.com

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.
B. Perform following operations in the order indicated:
1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
b. Removal of existing floor covering, unless noted for removal by Owner's Abatement Contractor.
2. Preliminary cleaning.
3. Epoxy Moisture Mitigation System application for existing slab on grade installations.
4. Patching, smoothing, and leveling, as required.
a. On remodeling projects, assume 33% of area will require filling, patching or leveling.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
B. Do not use solvents or other chemicals for cleaning.

3.04 PREPARATION

A. See individual floor covering section(s) for additional requirements.
B. Comply with requirements and recommendations of floor covering manufacturer.
C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
1. Achieve a substrate that is flat to within 1/8” in 10’.

3.05 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations as noted in Part 1 of this specification under CONCRETE MOISTURE AND ADHESION.

3.06 APPLICATION OF EPOXY MOISTURE MITIGATION SYSTEM.

A. Comply with requirements and recommendations of coating manufacturer.

END OF SECTION 09 05 61

SECTION 09 21 16
GYPSUM WALLBOARD ASSEMBLIES

TURN OFF GYPSUM TILE BACKER BOARD
TURN OFF CEMENT TILE BACKER BOARD (WET PLUMBING WALL)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum wallboard assemblies.
B. Non load bearing rated and non-rated metal stud wall assemblies.
C. Metal channel ceiling framing.
D. Resilient sound hat channels and/or isolation clips.
E. Sound batt insulation.
F. Mold and moisture resistant gypsum wallboard on the inside face of exterior stud walls or on top of hat channels on exterior masonry/concrete walls.
G. Cementitious backing board "Cement Board" as a substrate for ceramic/porcelain tile with-in two feet (0.6096 m) horizontally of water closets and urinals on the wet wall or to an inside corner, whichever is greater. Cement board to be the same height as the tile. Coordinate exact transitions with the tile installer.
    1. As indicated on the drawings at other locations.
H. Tile backer board as a substrate for ceramic or porcelain tile.
I. Gypsum wallboard.
J. Joint treatment and accessories.
K. Installation of acoustic spray system at top of walls and miscellaneous penetrations (sealing of mechanical/electrical penetrations are by those trades).
L. Acoustic sealant at stud walls at locations noted on the drawings.
M. Wall reinforcing as required to support partial height walls.
N. Gypsum board adhered directly to concrete or concrete block substrates.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on installation of acoustic spray system (including application thickness of spray).
C. UL listings for rated assemblies from manufacturer of framing/gypsum board products for:
    1. Rated gypsum wallboard partitions.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling
    1. Deliver materials to the project site with manufacturer's labels intact and legible.
    2. Handle materials with care to prevent damage.
    3. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.
    4. The plastic packaging used to wrap gypsum panel products for shipment is intended to provide temporary protection from moisture exposure during transit only and is not intended to provide protection during storage after delivery. Such plastic packaging shall be removed immediately upon receipt of the shipment.
    5. Failure to remove protective plastic shipping covers can result in condensation which can lead to damage, including mold.
B. Storage
    1. Store materials inside under cover, stack flat, properly supported on a level surface, all in same direction, off of floor. Gypsum panel products to be fully protected from weather, direct sunlight exposure and condensation. Gypsum materials with water damage shall be removed from the jobsite.
    2. Avoid overloading floor system
    3. Store adhesives in dry area; provide protection against freezing at all times.
    4. Steel framing and related accessories shall be stored and handled in accordance with AISI's "Code of Standard Practice".

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: As noted on wall types on the drawings.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with fire ratings as noted on the drawings
   1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
   2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com.
   2. Equivalent products by other manufacturers are acceptable.

C. Non-structural Framing System Components: ASTM C645; galvanized sheet steel (ASTM 645M G40 [Z120]), of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
   1. Studs: C-shaped with flat, knurled or embossed faces.
      a. Metal thickness:
         1) 20 gauge or ProSTUD 20 gauge equivalent.
         2) 25 gauge or ProSTUD 25 gauge equivalent.
      b. Size: 1-5/8 inch (41.275 mm), 2-½ inch (63.5 mm), 3-5/8 inch (92.075 mm), 4 inch (101.6 mm), 6 inch (152.4 mm) or 8 inch (203.2 mm) deep as noted on drawings.
   2. Runners: U shaped, sized to match studs.
   3. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
   4. Furring Members: Zee-shaped sections, minimum depth of 1 inch (25 mm).
      a. Products:
         1) Same manufacturer as other framing materials.
   5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (13 mm) channel depth.
      a. Products:
         1) ClarkDietrich; RC Deluxe Resilient Channel: www.clarkdietrich.com.
   6. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators, attaches to framing; improves noise isolation performance of wall and floor-ceiling assemblies.
      a. Products:
         1) ClarkDietrich; Sound Clip (CDSC): www.clarkdietrich.com.

D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.

E. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
      a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
      b. Height: As required for wall height.
      c. Products:
         1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com.

F. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
   1. Products:
      a. USG Corporation; Drywall Suspension System: www.usg.com.
      b. Rockfon Chicago Metallic Corporation; Drywall Furring 640/660: www.rockfon.com.

c. Armstrong World Industries; Drywall Suspension Systems: www.armstrongceilings.com.

2.03 WALLBOARD MATERIALS

A. Manufacturers:
   1. Any manufacturers who comply with the specification are acceptable.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use only at soffits, gypsum wallboard on furring and partitions that do not go to structure.
   2. Surface Paper: 100% recycled content paper on front, back and long edges.
   3. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
      b. Soffit/Ceilings: 5/8 inch (16 mm).

C. Fire-resistant Rated Wallboard:
   1. Application: For use at all locations and wallboard types unless noted otherwise in this specification.
   2. Type: Fire-resistance-rated Type X or requirements of ASTM C 1396 Standard Specification for Gypsum Board, UL or WH listed.
   3. Surface Paper: 100% recycled content paper on front, back and long edges.
   4. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
   5. Thickness: 5/8 inch (16 mm).

D. Mold and Moisture Resistant Wallboard:
   1. Application: Use at interior face of exterior stud walls, ceiling joists under attics and on furring attached to inside face of exterior masonry/concrete walls.
   2. Surface Paper: Coated fiberglass mat on face, back and long edges.
   3. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
   4. Humidified Deflection: Not more than ¼" when tested in accordance with ASTM C473 and C1658.
   5. Water Absorption: Less than 5% of weight when tested in accordance with C1396M and C1658.
   6. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273
   7. Thickness: 5/8 inch (16 mm).

E. Cement Based Tile Backer Board "Cement Board"
   1. Application:
      a. Behind ceramic/porcelain tile with-in two feet (0.6096 m) of water closets and urinals.
      b. Behind porcelain and ceramic tile in showers.
      c. As a substrate for ACF Soffits.
      d. Other locations as noted on the drawings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   4. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473.
   5. Glass Mat Faced Board for showers: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
      a. Regular Type: Thickness 5/8 inch (16 mm).
      b. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch (16 mm).

F. Gypsum Tile Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Permanence: Not more than 1.0 perms when tested in accordance with ASTM E96.
   4. Humidified Deflection: Not more than ¼" when tested in accordance with ASTM C473 and C1178.
   5. Water Absorption: Less than 5% of weight when tested in accordance with C1396M and C1178.
   6. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   7. Type X Thickness: 5/8 inch (16 mm).
   8. Regular Board Thickness: 5/8 inch (16 mm).

9. Edges: Tapered.

2.04 GYPSUM BOARD ACCESSORIES

A. Sound Batt Insulation: Refer to Section 07 21 00 Insulation for requirements.

B. Acoustic Spray System: Refer to Section 07 21 00 Insulation for requirements.

C. Acoustic Sealant: Conforming to ASTM C 919, Standard Practice for Use of Sealants in Acoustical Applications.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, aluminum coated, galvanized steel or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
   2. L-Trim with Tear-Away Strip: Sized to fit 5/8 inch (16 mm) thick gypsum wallboard.
   3. Expansion Joints:
      a. Type: V-shaped metal with factory-installed protective tape.

E. Joint Materials: ASTM C475/C475Mand as recommended by gypsum wallboard manufacturer for project conditions.
   1. Interior Gypsum Wallboard:
      a. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.
   2. Glass-Matt Gypsum Wallboard:
      a. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.
   3. Other Panels:
      a. As recommended by wallboard manufacturer.
   4. Joint Compound for Interior Gypsum Wallboard: Drying type, vinyl-based, field-mixed or ready-mixed.
   5. Joint Compound for Glass-matt Gypsum Wallboard: As recommended by wallboard manufacturer.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

I. Adhesive for Attachment to Masonry/Concrete,Wood, ASTM C557 and Metal:
   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).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.
   1. If items need correction, contact the Construction Manager or General Contractor.
      a. Do Not proceed with installation until conditions have been corrected.

3.02 FRAMING INSTALLATION

A. Metal Stud Schedule:
   1. Use 25 gauge or equivalent knurled or embossed metal studs on partitions up to 12 feet (3.66 m) high and soffits.
   2. Use 20 gauge or equivalent knurled or embossed metal studs on:
      a. Metal stud partitions over 12 feet (3.66 m) and less than 18 feet (5.49 m) high.
      b. Metal stud framed ceilings.
      c. Double studs at each door and borrowed light jamb and head up to 36 inches (914.4 mm) wide. For frame wider than 36 inches (914.4 mm) provide an additional full height stud at each jamb for every 32 inches (812.8 mm) of additional width.
      d. Two (2) - 16 gauge studs at mounting points of handicapped grab bars, wall mounted handicapped benches and diaper changing stations as occurs on stud walls.
      e. For partitions of any height covered with abuse or high impact resistant gypsum board.
      f. For partitions of any height covered with cement board.
   3. Use 16 gauge or equivalent knurled or embossed metal studs on partitions over 18 feet (5.49 m) high.

B. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

C. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/8" in 10'-0" (3.175mm- 3.05M).
   2. Suspend ceiling hangers from building structural members and as follows:
      a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum not part of supporting structural or ceiling suspension system.
      b. Splay hangers only where required to miss obstruction s and offset resulting horizontal forces by bracing, counter splaying or other equally effective means.
      c. Where widths of ducts and other construction within ceiling plenum produce hanger spacing that interfere with the location of hangers at spacing required to support standard suspension system members, install supplemental suspension system members and hangers in form of trapezes or equivalent devices.
         1) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
      d. Secure wire hangers to structure, by looping or wire tying, directly to supporting structure, including intermediate framing members. Attach to inserts, eye screws, or other devices appropriate for structure to which hangers are attached as well as for type of hanger involved in manner that will not cause deterioration or failure, due to age, corrosion or elevated temperatures.
      e. Laterally brace entire suspension system.
      f. Do not attach hangers to metal roof deck or metal deck tabs.
      g. Do not connect or suspend steel framing from ducts, pipes or conduits.
      h. Keep hangers and braces 2 inches clear of ducts, pipes and conduits.
      i. Wire-tie or clip furring members to main runners and to other structural supports.
      j. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension system abuts vertical surfaces. Mechanically join main beam and cross furring members to each other and butt cut to fit wall track.
      k. Where suspended ceiling assemblies abut building structure horizontally at ceiling perimeters or penetrations of ceiling.
      l. Install bracing as required at exterior locations to resist wind uplift.

D. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing as indicated on the drawings.
   2. Where studs or runners are installed directly against masonry walls or concrete floors/walls, set studs in acoustical sealant.
   3. Installation Tolerances: Install each steel framing and furring member so that fastening surface does not vary more than 1/8 inch (3.175 mm) from plane of faces of adjacent framing.
   4. Ensure that steel framing is isolated from building structure to prevent transfer of loading imposed by structural movement, at location indicated below to comply with details shown on drawings.
      a. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

E. For STC-rated or fire-resistance rated partitions that extend full height, install framing around structural members, as required to support gypsum board closures needed to make partitions continuous from floor to underside of structure above.

F. Brace partition framing, not extending full height to structure above, with studs same size and thickness as partition framing. Provide bracing at:
   1. 6 foot (1.8288 m) o.c. intervals along length of partitions.
   2. Not less than 6 foot (1.8288 m) from partition ends and corners.
   3. Door and window openings.

G. Do not bridge building expansion and control joints with steel framing or furring members, independently frame both sides of joints with framing or furring members or as indicated.

H. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

1. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum wallboard manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

I. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum wallboard, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
   1. Orientation: Vertical.
   2. Spacing: At 16 inches on center (At 400 mm on center).

J. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.

K. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, in accordance with clip manufacturer's written instructions.

L. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

M. Blocking: Comply with details indicated and with recommendations of gypsum wallboard manufacturer.
   1. Install mechanically fastened steel sheet blocking or plywood blocking for support of:
      a. Framed openings.
      b. Wall-mounted cabinets.
      c. Plumbing fixtures.
      d. Toilet partitions.
      e. Toilet accessories.
      f. Wall-mounted door hardware.
      g. Marker and Tack Boards.
      h. Handrails.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum wallboard.

C. Acoustic Spray System:
   1. Install mineral wool backing at depth required per manufacturer’s details.
   2. Apply acoustic spray to required thickness and overlap onto adjacent surfaces as recommended by manufacturer to achieve specified sound transmission classification.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Do Not install imperfect, damaged or damp/wet/water damaged boards.

C. Single-Layer Nonrated: Install gypsum wallboard perpendicular to framing on walls 8 feet -1 inch (2.46379 m) or less in height with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

D. Double-Layer, Nonrated: Use gypsum wallboard for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

E. Fire-Resistance-Rated Construction: Install gypsum wallboard in strict compliance with requirements of assembly listing.

F. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide except where full grout is shown. Apply spot grout at each jamb anchor clip just before inserting board into frame.

G. Form control joints and expansion joints at locations indicated or as recommended, with space between edges of boards, prepared to receive trim accessories.

1. Where a control joints occurs in an acoustical or fire-rated system, blocking shall be provide behind the control joint by using a backing material such as 5/8 inch (15.875 mm) type X gypsum panel product, or other tested equivalent.

H. Cover both faces of metal stud partition framing with gypsum board in concealed spaces (above ceiling, etc.), except in chase walls which are braced internally.

I. Except where concealed application is indicated or required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft. (0.74322 sq. m.) area, and may be limited to not less than 75 percent of full coverage.

J. Fit gypsum wallboard around ducts, pipes and conduits.

K. Isolate perimeters of non-load-bearing drywall partitions at structural abutments. Provide ¼ to ½ inch (6.35 to 12.7 mm) space to accept trim edge.

L. Where STC-rated gypsum wallboard assemblies are indicated or drawings indicate acoustical sealant, seal construction at perimeters, behind control and expansion joints, openings, and other penetrations with a continuous bead of acoustical sealant. Include a bead of sealant at both faces of partitions.

M. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound flanking paths around or through gypsum wallboard assemblies, including partitions extending above ceilings.

N. Where resilient furring channels are used over steel framing, the screws used to attach the gypsum panel product to the furring channels shall not contact the framing.

O. Gypsum panel products applied to walls shall be applied with the bottom edge spaced a minimum of 1/8 inch (3.175 mm) and maximum of ¼ inch (6.35 mm) above the floor.

P. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum wallboard), comply with gypsum wallboard manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

Q. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
   2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum wallboard abuts dissimilar materials.
   1. Allow for a 3/8 inch (9.525 mm) gap to apply a sealant joint when indicated on the drawings.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Wallboard: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Wallboard: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum wallboard in accordance with levels defined in ASTM C840, as follows:
   1. Level 5:
      a. All joints and interior angles shall have tape embedded in joint compound and two separate coats for joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. When necessary, sand between coats and following final coat to provide smooth surface ready for decoration.
      b. For use on:
         1) All ceilings.
         2) Walls and/or soffits under skylights and clerestories.
         3) Walls with glass faced board, and as noted on drawings.

4) Recoating walls where wallcovering has been removed.

c. When Level 5 finish is used, it shall extend to nearest inside or outside corner.

2. Level 4:
   a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. When necessary, sand between coats and following final coat to provide smooth surface ready for decoration.
   b. For use on:
      1) Walls scheduled for paint or wallcovering except those areas noted under Level 3 and 5.
3. Level 3:
   a. All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
   b. For use on surfaces of mechanical and electrical spaces scheduled to receive paint.
      1) Surfaces of mechanical and electrical spaces scheduled to receive paint.
4. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
   a. All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
   b. For use on:
      1) Substrates for tile
      2) Substrates for wood paneling.
5. Level 1/Fire Taping:
   a. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Tape and fasteners need not be covered.
   b. For use on:
      1) For use in plenum areas above ceilings.
      2) Gypsum wallboard not scheduled for paint or wallcovering.
      3) Gypsum wallboard concealed from view in the finished work, except as noted in level 2.

3.07 FINISHING ADJUSTMENT

A. Screw Pop
   1. Repair nail pop by driving new screw approximately 1-1/2 inches away and reseat screw.
   2. When face paper is punctured drive new screw approximately 1-1/2 inches from defective fastening and remove defective fastening.
   3. Fill damaged surface with compound in coats specified by required finish level.

B. Ridging
   1. Sand ridges to reinforcing tape without cutting through tape.
   2. Fill concave areas on both sides of ridge with topping compound.
   3. After fill is dry, blend in topping compound over repaired area.

C. Fill cracks with compound and finish smooth and flush.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Wallboard Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.09 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Protect installed products from damage from weather, condensation, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, or mold damaged.

D. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

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

END OF SECTION 09 21 16

SECTION 09 30 00

TILE

TURN OFF FLOOR & WALL PORCELAIN TILE (LARGE FORMAT)
TURN OFF QUARRY TILE
TURN OFF DECORATIVE FLOOR & WALL TILE (MOSAIC, STONE, GLASS)
TURN OFF MORTAR BED
TURN OFF SOLID SURFACE AT HAND DRYERS
TURN OFF LINEAR FLOOR DRAINS (FOR LARGE FORMAT TILE)
TURN OFF METAL TRIM FOR TILE (CORNERS, COVE BASE)
TURN OFF FOR NEW BUILDINGS (NO REMODELING)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor preparation as specified in Section 09 05 61 - Common Work Results for Flooring Preparation:
   1. Substrate Prep and Patching.
   2. Porosity Inhibiting Admixture (PIA) in new slabs.
B. Tile for floor applications.
   1. Porcelain Tile (P TILE-_).
   2. Quarry Tile (Q TILE-_).
   3. Decorative Tile:
      a. Mosaic (D TILE-_).
      b. Stone (D TILE-_).
C. Tile for wall applications.
   1. Porcelain Tile (P TILE-__).
   2. Decorative Tile:
      a. Mosaic (D-TILE-_).
      b. Stone (D TILE-_).
      c. Glass (D TILE-_).
D. Mortar bed installations in toilets, showers and other areas shown on the drawings over depressed substrates.
E. Accessories.
   1. Metal trim at outside corners and top of wainscot.
   2. Metal coved base.
   3. Caulking of inside corners of tile.
   4. Provide and install solid surface panels at hand dryers.
   5. Linear floor drains as detailed/noted on the drawings.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at least three weeks before starting work of this section to discuss conformance with the requirements of specification and job site conditions.
B. Required attendance by:
   1. Representatives of Owner, Architect, General Contractor or Construction Manager, Tile Subcontractor, Tile Manufacturer, Installation System Manufacturer (required to maintain warranty), Plumbing subcontractor and any other parties who are involved in the scope of this installation must attend the meeting.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
   1. Indicate locations and sizes of linear floor drains and connection locations for the plumbing subcontractor's use.
   2. Details and Locations of Solid Surface Panels for use at hand dryers
D. Samples:

1. Submit one set of tile samples for Architects review and one set of samples for use by the Construction Manager/General Contractor for the jobsite trailer.
2. Submit grout samples for selection by Architect, unless the colors indicated on the Interior Material Finish Schedule are being used.
3. Submit samples of sealant colors that match grout colors.

E. Submit documentation to the Construction Manager/General Contractor to have on file at the jobsite trailer, confirming that the waterproofing membrane used in toilet rooms/showers are in compliance with the local plumbing code.

F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer indicating compliance with TCA 137.1.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.04 QUALITY ASSURANCE

A. Maintain one copy of ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with a minimum ten years of documented experience.

1.05 FLOOR FLATNESS

A. For new concrete slabs on grade and elevated structural slabs/topping as specified in Section 03 30 00 floor flatness is specified per ACI 117 as follows:
1. F (F) Flat tolerance with an overall value of 35 and a minimum localized value of 21.
2. F (L) Flat tolerance with an overall value of 25 and a minimum localized value of 15.
3. Measured by a manual straightedge method a “flat” floor surface classification, maximum gap for 90% compliance, samples not to exceed ¼” and for 100% compliance, samples not to exceed 3/8”.

B. The flooring contractor will be responsible to provide the necessary means (i.e., grinding/leveling) for additional leveling as required by the flooring manufacturer.

1.06 MOCK-UPS

A. Construct tile mock-up for each type/style/finish/size/color, incorporating all components specified.
1. Approved mock-up may remain as part of work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and rising and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

1.09 WARRANTY

A. The manufacturer of adhesives, mortars, grouts, and other installation materials shall provide a written twenty-five (25) year warranty, which covers materials and labor; reference Manufacturer Warranty Data Sheet for complete details and requirements.

B. For exterior facades over steel or wood framing, the manufacturer of adhesives, mortars, grouts and other installation materials shall provide a written ten (10) year warranty, which covers replacement of Manufacturer products only – reference Warranty Data Sheet for complete details and requirements.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products of each type by the same manufacturer.

B. Manufacturers listed in this specification are approved under the following conditions:
1. A manufacturer listed in both the specification and the Interior Material Finish/Color Schedule, on Architectural Drawings is not required to submit a pre-bid approval.
2. Manufacturers listed in this specification, but not in the Interior Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval by addendum. Refer to Substitution Section 01 25 00.
3. When no colors are listed in the Interior Material Finish/Color Schedule, on Architectural Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

C. Glazed Ceramic Wall Tile:
1. Type: (C TILE-_)

a. Manufacturer: _____
b. Product: _____
c. Size: 4-1/4 by 4-1/4 inch (108 by 108 mm), nominal.
d. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
e. Pattern: As indicated on the drawings.
f. Trim Units: Matching bullnose, cove, and base shapes in sizes coordinated with field tile.

2. Type: (C TILE-_)
a. Manufacturer: _____
b. Product: _____
c. Size: 4-1/4 by 4-1/4 inch (108 by 108 mm), nominal.
d. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
e. Pattern: As indicated on the drawings.
f. Trim Units: Matching bullnose, cove, and base shapes in sizes coordinated with field tile.

3. Type: (C TILE-_)
a. Manufacturer: _____
b. Product: _____
c. Size: 4-1/4 by 4-1/4 inch (108 by 108 mm), nominal.
d. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
e. Pattern: As indicated on the drawings.
f. Trim Units: Matching bullnose, cove, and base shapes in sizes coordinated with field tile.

4. Type: C TILE-_
a. Manufacturer: _____
b. Product:
c. Size: 4-1/4 by 4-1/4 inch (108 by 108 mm), nominal.
d. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
e. Pattern: As indicated on the drawings.
f. Trim Units: Matching bullnose, cove, and base shapes in sizes coordinated with field tile.

D. Quarry Tile: (Q TILE-_)
1. Manufacturer: _____
2. Product: _____
3. Moisture Absorption: Over 3.0 but not more than 5.0 percent as tested in accordance with ASTM C373.
4. Size: 6 by 6 inch (152 by 152 mm), nominal.
5. Thickness: 1/2 inch (12.7 mm), nominal.
6. Surface Finish: Unglazed.
7. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
8. Trim Units: Matching bullnose, double bullnose, cove, and cove base shapes in sizes coordinated with field tile.

E. Porcelain Tile:
1. Type: Porcelain Tile (P TILE-_)
a. Manufacturer: _____
b. Product: _____
c. Size: 12 x 24 inch (305 x 610 mm), nominal.
d. Thickness: 3/8 inch (9.5 mm).
e. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
f. Pattern: As indicated on the drawings.
g. Trim Units: Matching bullnose, cove base, and cove shapes in sizes coordinated with field tile.

2. Type: Porcelain Tile (P TILE-_)
a. Manufacturer: _____
b. Product: _____
c. Size: [12 x 24] inch ([305 x 610] mm), nominal.
d. Thickness: 3/8 inch (9.5 mm).Thickness: 3/8 inch (9.5 mm).
e. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.

f. Pattern: As indicated on the drawings.
g. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.

3. Type: Porcelain Tile (P TILE-_)
   a. Manufacturer: _____
   b. Product: _____
   c. Size: [12 x 24] inch ([305 x 610] mm), nominal.
   d. Thickness: 3/8 inch (9.5 mm).Thickness: 3/8 inch (9.5 mm).
   e. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
   f. Pattern: As indicated on the drawings.
   g. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.
4. Type: Porcelain Tile (P TILE-_)
   a. Manufacturer: _____
   b. Product: _____
   c. Size: [12 x 24] inch ([305 x 610] mm), nominal.
   d. Thickness: 3/8 inch (9.5 mm).Thickness: 3/8 inch (9.5 mm).
   e. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
   f. Pattern: As indicated on the drawings.
   g. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.

F. Decorative Tile:
1. Type: Decorative Tile (D TILE-_)
   a. Manufacturer: _____
   b. Product: _____
   c. Size: 2 by 2 inch (51 by 51 mm), nominal.
   d. Shape: Square.
   e. Edges: Square.
   f. Surface Finish: Unglazed.
   g. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
   h. Color(s): _____.
   i. Color(s): To be selected by Architect from manufacturer's standard range.
   j. Pattern: As indicated on the drawings.
   k. Factory set patterns: Provide patterns set in tile sheets by manufacturer.
   l. Trim Units: Matching cove and surface bullnose shapes in sizes coordinated with field tile.
      1) Integral Coved Base: Dal-Tile MB5a for 2" x 2" base without bullnose top and MB5B 2" x 2" base with bullnose top.
2. Type: Decorative Tile (D TILE-_)
   a. Manufacturer: _____
   b. Product: _____
   c. Size: 2 by 2 inch (51 by 51 mm), nominal.
   d. Shape: Square.
   e. Edges: Square.
   f. Surface Finish: Unglazed.
   g. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
   h. Color(s): _____.
   i. Color(s): To be selected by Architect from manufacturer's standard range.
   j. Pattern: As indicated on the drawings.
   k. Factory set patterns: Provide patterns set in tile sheets by manufacturer.
   l. Trim Units: Matching cove and surface bullnose shapes in sizes coordinated with field tile.
      1) Integral Coved Base: Dal-Tile MB5a for 2" x 2" base without bullnose top and MB5B 2" x 2" base with bullnose top.
3. Type: Decorative Tile (D TILE-_)

a. Manufacturer: _____
b. Product: _____
c. Size: 1 by 1 inch (25 by 25 mm), nominal, tiles on 12 by 12 inch (305 by 305 mm), nominal, mesh backing.
d. Thickness: 5/16 inch (8 mm).
e. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
f. Pattern: As indicated on the drawings.

4. Type: Decorative Tile (D TILE-_)
   a. Manufacturer: _____
   b. Product:
   c. Size: 1 by 1 inch (25 by 25 mm), nominal, tiles on 12 by 12 inch (305 by 305 mm), nominal, mesh backing.
   d. Thickness: 5/16 inch (8 mm).
   e. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
   f. Pattern: As indicated on the drawings.
5. Type: Decorative Tile (D TILE-_)
   a. Manufacturer: _____
   b. Product: _____
   c. Size: _____ inch (_____ mm) by _____ inch (_____ mm)
   d. Thickness: 5/8 inch (15.9 mm).
   e. Face: Natural fissured.
   f. Surface Finish: Tumbled.
   g. Edges: Square.
   h. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
   i. Pattern: As indicated on the drawings.
6. Type: Decorative Tile (D TILE-_)
   a. Manufacturer: _____
   b. Product: _____
   c. Size: _____ inch (_____ mm) by _____ inch (_____ mm)
   d. Thickness: 5/8 inch (15.9 mm).
   e. Face: Natural fissured.
   f. Surface Finish: Tumbled.
   g. Edges: Square.
   h. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.
   i. Pattern: As indicated on the drawings.

G. Extra Tile Products
   1. Furnish 1% of each type/shape//color of tile used on this project to Owner as maintenance stock.

2.02 SETTING MATERIALS

A. Provide setting and grout materials from the same manufacturer.
B. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com.
   2. Bostik Inc: www.bostik.com.
   3. Custom Building Products: www.custombuildingproducts.com.
   4. H.B. Fuller Construction Products, Inc: www.tecspecialty.com.
   5. LATICRETE International, Inc: www.laticrete.com.
   6. Mapei Corporation: www.mapei.com
C. Flooring Installations
   1. Waterproofing on floors of showers (slab on grade), toilet rooms (slab on grade and above grade) and locker rooms on above grade locations meeting ANSI A118.10 & A118.12. (TCNA F121 or F122). Waterproofing membrane shall be in compliance with Uniform Plumbing Code (UPC) and International Plumbing Code (IPC):
      Ardex: 8+9
      Bostik: Ultra-set Advanced or Gold Plus

Custom: RedGard
Laticrete: HYDRO BAN
Mapei: Mapelastic AquaDefense and Mapebond
TEC: Hydra-Flex Membrane

2. Waterproofing on floors of showers (above grade) meeting ANSI A118.10 & A118.12. Waterproofing membrane shall be in compliance with Uniform Plumbing Code (UPC) and International Plumbing Code (IPC). (TCNA F121 or F122):
   Ardex: 8+9 & SK Mesh
   Bostik: Blacktop and Anti Fracture membrane or Gold Plus and Reinforcing Tape
   Custom: 9240 Waterproofing & Anti-Fracture Membrane
   Laticrete: 9235 Waterproofing & reinforcing fabric
   Mapei: Mapelastic AquaDefense and Reinforcing Fabric
   TEC: Hydra-Flex Membrane and Waterproofing Mesh
3. Setting bed for tile on concrete slabs-on-grade, mortar bed. Polymer modified mortar meeting ANSI A118.4, A118.11 and A118.15 (TCNA F111 or F113):
   Ardex: X 77 MICROTEC
   Bostik: BAM
   Custom: ProLite
   Laticrete: 254 Premium
   Mapei: Ultraflex 3
   TEC: SuperFlex
4. Setting bed for large format tile, >15" in any direction on concrete slabs-on-grade, mortar bed. Polymer modified MORTAR meeting ANSI A118.4, A118.11 and A118.15 (TCNA F111 or F113):
   Ardex: X 78 MICROTEC
   Bostik: BAM
   Custom: ProLite
   Laticrete: 257 Titanium
   Mapei: Ultraflex LFT
   TEC: Isolight

D. Vertical Installations
1. Setting bed for tile on vertical substrates meeting ANSI A118.4, A118.11 and A118.15 (TCNA W245):
   Ardex: X 77 MICROTEC
   Bostik: BAM
   Custom: ProLite (Interior), ProLite + RedGard (Exterior)
   Laticrete: 254 Platinum
   Mapei: Ultraflex 3
   TEC: 3N1 Performance
2. Setting bed for tile in showers meeting ANSI A118.4E, A118.11 and A118.15 (TCNA W244C/W245):
   Ardex: X 77 MICROTEC with E 90 Mortar Admix
   Bostik: BAM with Gold Plus
   Custom: ProLite
   Laticrete: 254 Platinum with 333 Super Flexible Additive
   Mapei: Ultraflex 3
   TEC: Ultimate 6 Plus over Hydra-Flex
3. Setting tile over existing glazed tile/well bonded painted surfaces meeting ANSI A118.4 and A118.11 (TCNA TR713):
   Ardex: X 77 MICROTEC over P51
   Bostik: Stonewall over TOTAL Prime
   Custom: VersaBond Fortified Thin-Set Mortar over MBP-Multi-Surface Bonding Primer
   Laticrete: 257 Titanium over PRIME-N-BOND

Mapei: Ultraflex LFT over ECO Prim grip
TEC: Ultimate 6 Plus over Multipurpose Primer

4. Setting bed for tile large format tile, >15" in any direction meeting ANSI A118.4, A118.11 & A118.15 (TNCA F121 or F122):
   Ardex: X 77 MICROTEC
   Bostik: BAM
   Custom: ProLite (Interior), ProLite + RedGard (Exterior)
   Laticrete: SELECT-BOND
   Mapei: Ultraflex LFT
   TEC: Ultimate 6 Plus
5. Setting bed for Decortive (glass) tiles meeting ANSI A118.4 & A118.11 (TNCA W245):
   Ardex: S 48
   Bostik: Glass-Mate
   Custom: Glass Tile Premium Thin-Set Mortar
   Laticrete: Glass Tile Adhesive Lite
   Mapei: Adesilex P10 with Keraply
   TEC: Ultimate 6 Plus or SuperFlex or IsoLight

E. Mortar Bed: Mixture of portland cement and sand, roughly in proportions of 1:5 with latex polymer as the liquid portion of the mixture.
1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
2. Reinforcing: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch diameter; comply with ASTM A 185 and ASTM A82 except for minimum wire size.

2.03 GROUTS

A. Provide setting and grout materials from the same manufacturer.
B. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com.
2. Bostik Inc: www.bostik.com.
3. Custom Building Product: www.custombuildingproducts.com.
4. H.B. Fuller Construction Products, Inc: www.tecspecialty.com.
5. LATICRETE International: www.laticrete.com.
6. Mapei Corporation: www.mapei.com.

C. For wall and floor tile grout, pre-mixed urethane grout:
Ardex: WA
Bostik: TruColor RapidCure
Custom: CEG Lite
Laticrete: SPECTRALOCK
Mapei: Kerapoxy CQ
TEC: AccuColor EFX

D. For quarry tile floors in food service areas: 100% solids epoxy grout meeting ANSI 118.3:
Ardex: WA
Bostik: EzPoxy EzClean
Custom: CEG-IG
Laticrete: SPECTRALOCK 2000 IG
Mapei: Kerapoxy IEG CQ
TEC: AccuColor EFX Epoxy Special Effects

E. Colors: See Interior Material Finish/Color Schedule, on Architectural Drawings.

2.04 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone; moisture and mildew resistant type.
1. Custom color to match tile grout color.

B. Tile Sealer: Stain protection for natural stone tile.
1. Products:
   a. Custom Building Products; Aqua Mix Enrich 'N' Seal: www.custombuildingproducts.com.

b. STONETECH, a division of LATICRETE international, Inc; STONETECH Heavy Duty Stone Sealer: www.laticrete.com.
c. Equivalent products by other manufacturers are acceptable.

2.05 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
2. Fluid or Trowel Applied Type with Reinforcing membrane:

B. Cleaners: As recommended by tile and/or grout manufacturers.

C. Provide leveling system for tiles over 24" in any dimension as recommended by tile manufacturer.

D. Thresholds: Solid polymer made from homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without precoated finish. Sizes as detailed on drawings.
1. Colors as selected by Architect to match field color of tile.

E. Metal Trim for Tile:
1. Manufacturers:
a. Schluter Systems: www.schluter.com.
b. Profilitec: www.profilitec.com.
2. Provide, splice connectors, end caps, inside and outside corners as warranted by application.
3. Products:
a. CT Corner Trim: (For use at outside corners of tile to tile and terminations of ceramic/porcelain tile to other materials).
b. Manufacturer/Product:
1) Schluter RONDEC RO x tile height x AE.
(a) Profilitec: ROUNDJOLLY RJ x tile height.
2) Stainless Steel Finish:
(a) Smooth-316L.
(b) Smooth-304.
(c) Brushed.
(d) Textured.
3) Aluminum Finish:
(a) Satin anodized.
(b) Polished chrome anodized.
(c) Brushed chrome anodized.
(d) Satin nickel anodized.
(e) Polished nickel anodized.
(f) Brushed nickel anodized.
(g) Satin copper anodized.
(h) Polished copper anodized.
(i) Brushed copper anodized.
(j) Brushed antique bronze anodized.
(k) Satin brass anodized.
(l) Polished brass anodized.
(m) Brushed brass anodized.
(n) Graphite anodized.
(o) Bright black anodized.
(p) Brushed black anodized.
(q) Textured color-coated aluminum. Color: _____
(r) Color-coated aluminum. Color: _____
c. CT Corner Trim: (For use at outside corners of tile to tile and terminations of ceramic/porcelain tile to other materials).
1) Manufactuer/Product:
(a) Schluter QUADEC profile Q x tile height.

(b) Profilitec: SQUAREJOLLY SJ x tile height.

2) Stainless Steel Finish:
   (a) Smooth.
   (b) Brushed.
   (c) Textured.

3) Aluminum Finish:
   (a) Satin anodized.
   (b) Polished chrome anodized.
   (c) Brushed nickel anodized.
   (d) Brushed antique bronze anodized.
   (e) Textured color-coated aluminum. Color: _____
   (f) Color-coated aluminum. Color: _____

d. Wainscot Trim: (For use at the top of all wainscot tile).
   1) Manufacturer/Product:
      (a) Schluter RONDEC DB x tile height.
      (b) Profilitec: ROUNDJOLLY RJ x tile height.
   2) Stainless Steel Finish:
      (a) Smooth-316L.
      (b) Smooth-304.
      (c) Brushed.
      (d) Textured.
   3) Aluminum Finish:
      (a) Satin anodized.
      (b) Polished chrome anodized.
      (c) Satin nickel anodized.
      (d) Brushed nickel anodized.
      (e) Brushed antique bronze anodized.
      (f) Textured color-coated aluminum. Color: _____
      (g) Color-coated aluminum. Color: _____

e. Wainscot Trim: (For use at the top of all wainscot tile).

f. Manufactuer/Product:
   1) Schluter QUADEC profile Q x tile height.
   2) Profilitec: SQUAREJOLLY SJ x tile height.

g. Stainless Steel Finish:
   1) Smooth.
   2) Brushed.
   3) Textured.

h. Aluminum Finish:
   1) Satin anodized.
   2) Polished chrome anodized.
   3) Brushed nickel anodized.
   4) Brushed antique bronze anodized.
   5) Textured color-coated aluminum. Color: _____
   6) Color-coated aluminum. Color: _____

i. CT Transition Strip (For use with Carpet to Ceramic/Porcelain Transition):
   1) Manufactuer/Product:
      (a) Schluter RENO-TK x tile height.
      (b) Profilitec: ZEROTEC ZRM x tile height.
   2) Stainless Steel Finish:
      (a) Smooth.
      (b) Brushed.
   3) Solid Brass.
   4) Aluminum Finish:

(a) Satin anodized.
(b) Bright chrome anodized.
(c) Satin nickel anodized.
(d) Brushed nickel anodized.
(e) Satin copper anodized.
(f) Brushed copper anodized.
(g) Brushed antique bronze anodized.
(h) Bright brass anodized.

j. CT Transition Strip (For use with Resilient Tile to Ceramic/Porcelian Tile Transition):
1) Manufactuer/Product:
2) Schluter RENO-U x tile height.
(a) Profilitec: ZEROTEC ZR-ZR60 x tile height.
3) Stainless Steel Finish:
(a) Smooth.
(b) Brushed.
4) Solid Brass.
5) Aluminum Finish:
(a) Satin anodized.
(b) Bright chrome anodized.
(c) Satin nickel anodized.
(d) Brushed nickel anodized.
(e) Satin copper anodized.
(f) Brushed copper anodized.
(g) Brushed antique bronze anodized.
(h) Satin brass anodized.
(i) Bright brass anodized.

k. CT Coved Base Trim (For use with new floor tile to new wall tile):
1) Manufactuer/Product:
(a) Schluter DILEX-AHK x tile height.
(b) Profilitec: SANITEC SB10 x tile height.
2) Aluminum Finish:
(a) Satin anodized.
(b) Polished chrome anodized.
(c) Brushed chrome anodized.
(d) Satin nickel anodized.
(e) Polished nickel anodized.
(f) Brushed nickel anodized.
(g) Satin copper anodized.
(h) Polished copper anodized.
(i) Brushed copper anodized.
(j) Satin brass anodized.
(k) Polished brass anodized.
(l) Brushed brass anodized.
(m) Brushed graphite anodized.
(n) Textured color-coated aluminum. Color: _____
(o) Color-coated aluminum. Color: _____

l. CT "Remodeling" Coved Base Trim (For use with existing floor tile to new wall tile):
1) Manufactuer/Product:
(a) Schluter DILEX-AHKA x tile height.
(b) Profilitec: SANITEC RS x tile height.
2) Aluminum Finish:
(a) Satin anodized.
(b) Brushed chrome anodized.

(c) Satin nickel anodized.
(d) Brushed nickel anodized.
(e) Textured color-coated aluminum. Color: _____

m. CT Stair Nosing:
1) Manufacturer/Product:
(a) Schluter TREP-B x tile height.
(b) Profilitec: STAIRTEC FSL.
2) 2 1/16" thermoplastic rubber insert
3) Color of insert: Gray, Dark Beige/Brown or Black.

F. Linear Floor Drain:
1. Manufacturers:
a. Infinity Drain: www.infinitydrain.com.
b. LATICRETE International: www.laticrete.com.
c. Profilitec: www.profilitec.com.
d. Schluter Systems: www.schluter.com.
1) Products:
(a) Stainless steel channel body with 2" no-hub outlet.
(b) Size: 2 ¼" wide trough with a 7/8" wide body flange laminated with a collar made of waterproof membrane. Lengths/quantities of drains as required to match width of area served.
(c) Grate Assembly: ¾" frame with locking mechanism, brushed stainless steel. Provide cover plate as needed for continuous installation.
2) Square perforated grate covers:
(a) Infinity Drain: Square Grate.
(b) Schluter KERDI-LINE Square (B).
3) Solid covers:
(a) Infinity Drain: Solid 65.
(b) Profilitec: SHOWERTEC STL F.
(c) Schulter Systems: SOLID (A).
4) Tiled covers:
(a) Infinity Drain: Tile Insert Frame.
(b) LATICRETE: Tile-in.
(c) Profilitec: SHOWERTEC STL CT.
(d) Schluter Systems: TILE (D)
5) Offset oval covers:
(a) Infinity Drain: Offset Oval.
(b) LATICRETE: Offset Oval.

G. Solid Surface for Hand Dryers
1. Manufacturer/Product and Colors:
a. See Interior Material Finish/Color Schedule, on Architectural Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
D. Verify that required floor-mounted utilities are in correct location.
E. Commencement of work implies acceptance of surface and assumption of responsibility for satisfactory results.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.
C. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.
D. Existing Surface Preparation: Completely remove all paint, soap scum, wax, coatings, oil, etc. from existing surfaces to receive tile. Perform mechanical abrasion with a carborundum disk followed by a clear water wash. Use other cleaning methods of soapless detergents, commercial tile cleaners or solvents or acids if required to adequately prep surfaces. Substrate must be thoroughly rinsed and dry before setting the new tile.

3.03 INSTALLATION - GENERAL

A. Install crack isolation membrane over minor cracks and non-structural slab joints to prevent transmission of cracking to tile. Strictly follow membrane and mortar manufacturers' printed instructions.
   1. For tile being installed on existing slabs on remodeling projects, assume 10 lineal feet of cracks requiring crack isolation membrane for every 50 square foot of area.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
E. Form internal angles square and external angles bullnosed.
F. Install ceramic accessories rigidly in prepared openings.
G. Install non-ceramic trim in accordance with manufacturer's instructions.
H. Install thresholds at transitions to adjacent materials to floor tile.
I. Sound tile after setting. Replace hollow sounding units.
J. Movement Joints.
   1. Install joints to control the effects of substrate movement on tile finishes.
   2. Construct joints in tile work according to movement joint details" EJ171" as published in TCNA "Handbook for Ceramic Tile Installation."
   3. For tile being installed on existing slabs on remodeling projects, assume 20 lineal feet of movement joints for every 400 square foot of area (the joints around the 20' x 20' perimeter are to be included in additon to the 20 lineal foot assumption).
   4. Locate movement joints at the following locations:
      a. Interior: 20' to 25' maximum in each direction.
      b. Exterior and Interior tile work exposed to direct sunlight or moisture: 8' to 12' maximum in each direction.
      c. Where tile work abuts restraining surfaces including but not limited to perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, inside corners of abutting walls, and where changes occur in backing materials.
      d. All expansion, control, construction, cold and seismic joints in the structure. Expansion joints in tile work must match width of joint in building structure.
      e. Keep control and expansion joints free of mortar, grout, and adhesive.
K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.
B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Use uncoupling membrane under all tile unless other underlayment is indicated.
   2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method and in accordance with manufacturer's instructions.
C. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
D. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F101, bonded, with standard grout.
B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
C. Cleavage Membrane: Lap edges and ends.
D. Waterproofing Membrane: Install as recommended by manufacturer .
E. Maximum Mortar Bed Thickness: 2 inch (51 mm), unless otherwise indicated.

3.06 INSTALLATION - WALL TILE

A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
C. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
D. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.07 SOLID SURFACE INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and manufacturer's instructions.

3.08 LINEAR FLOOR DRAIN INSTALLATION

A. Install linear floor drains in accordance with manufacturer's instructions.

3.09 CLEANING AND PATCHING

A. Clean tile and grout surfaces.
B. Clean linear floor drains of all debris when construction is completed. Test all drain systems to verify compliance.
C. Point open joints and replace defective work.

3.10 PROTECTION

A. Do not permit traffic over work in progress and over finished floor surface for 4 days after installation.
B. Protect installed linear floor drains until completion of project. Touch-up, repair or replace damaged products just prior to substantial completion.
C. Finished tile floors: Covered with clean building paper before foot traffic is permitted on them. Place board walkways on floors that are to be continuously used as passageways by workers. Protect tiled vertical outside corners with board corner strips in areas used as passageways by workers.

END OF SECTION 09 30 00

SECTION 09 51 00
ACOUSTICAL CEILINGS

TURN OFF VINYL COVERED TILES
TURN OFF CEMENTITIOUS TILES (TECTUM)
TURN OFF ACOUSTICAL TILES GLUED TO GYP SUBSTRATE
TURN OFF SCORED ACT
TURN OFF STEPPED EDGE ACT
TURN OFF HEAT/HUMIDITY, CORRESIVE/CHEMICAL FUME & STEAM ACT
TURN OFF CLOUD EDGE OR TRANSITION METAL TRIM
TURN OFF ACT HOLD DOWN CLIPS
TURN OFF SIESMIC REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid acoustical ceiling system.
   1. Lay-in Acoustical.
   2. Lay-in Vinyl/Gypsum.
   3. Lay-in Cementious.

B. Acoustical tiles glued to gypsum ceiling substrate.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 5-1/2 by 5-1/2 inch (139.7 by 139.7 mm) in size illustrating material and finish of acoustical units.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Acoustical Units: ____ sq ft (____ sq m) of each type and size.
   2. Extra Acoustical Units: Quantity equal to 2 percent of total installed.

1.04 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.05 WARRANTY

A. Manufacturers standard 30 year warranty covering tile and grid systems which include:
   1. Red Rust Warranty
   2. Sag Warranty.
   3. Mold and Mildew Warranty
   4. Corrosive Warranty for Ceramic Tiles.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG Corporation: www.usg.com/ceilings.

B. Vinyl Covered Gypsum Tiles:
   1. CertainTeed Corporation: www.certainteed.com.
   2. National Gypsum: www.nationalgypsum.com.
   3. USG Corporation: www.usg.com/ceilings.

C. Cementious Tiles/Panels:
   1. Armstrong World Industries, Inc/Tectum: www.tectum.com.

D. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.

2. Rockfon/Chicago Metallic: www.rockfon.com.
3. USG Corporation: www.usg.com/ceilings.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119.

B. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
1. Local authorities having jurisdiction.

2.03 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
1. VOC Content: Certified as Low Emission.

B. Lay-In Panels
1. Acoustical Panels ACT 1: Painted mineral fiber, sag and abuse resistant, anti-microbial, low VOC with the following characteristics:
   a. Classification: ASTM E1264 Type III.
   b. Fire Rating: Class A with Flame Spread Index of 25 or less and Smoke Developed Index of 50 or less when tested in accordance with ASTM 85.
   c. UL Listed Fire Rated Tile.
   d. Minimum Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
   e. Minimum NRC: 0.50, determined in accordance with ASTM E1264.
   f. Minimum Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   g. Tile Edge: Square.
   h. Color: White.
   i. Suspension System: Exposed grid.
   j. Products:
      1) Armstrong World Industries, Inc; Tundra Humigard #302: www.armstrongceilings.com.
      2) CertainTeed Corporation; School Board FFSB-197: www.certainteed.com.
      3) USG Corporation; Pebbled ClimaPlus #4800: www.usg.com/ceilings.
2. Acoustical Panels ACT 2: Painted mineral fiber, sag and abuse resistant, anti-microbial, low VOC with the following characteristics:
   a. Classification: ASTM E1264 Type III.
   b. Size: 24 by 24 inches (610 by 610 mm).
   c. Thickness: 5/8 inches (16 mm).
   d. Fire Rating: Class A with Flame Spread Index of 25 or less and Smoke Developed Index of 50 or less when tested in accordance with ASTM 85.
   e. UL Listed Fire Rated Tile.
   f. Minimum Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
   g. Minimum NRC: 0.50, determined in accordance with ASTM E1264.
   h. Minimum Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   i. Tile Edge: Square.
   j. Color: White.
   k. Suspension System: Exposed grid.
   l. Products:
      1) Armstrong World Industries, Inc; Tundra Humigard #301: www.armstrongceilings.com.
      2) CertainTeed Corporation; School Board FFSB-157: www.certainteed.com.
      3) USG Corporation; Pebbled ClimaPlus #4801: www.usg.com/ceilings.
3. Acoustical Panels ACT 3: 2 mil (0.0508 mm) vinyl laminated to a gypsum core, sag resistant, USDA approved, low VOC with the following characteristics:
   a. Classification: ASTM E1264 Type XX.
   b. Size: 24 by 48 inch (610 by 1219 mm).
   c. Thickness: 1/2 inches (12.7 mm).
   d. Fire Rating: Class A with Flame Spread Index of 5 or less and Smoke Developed Index of 0 when tested in accordance with ASTM 85.
   e. UL Listed Fire Rated Tile.

f. Minimum Light Reflectance: 75 percent, determined in accordance with ASTM E1264.
g. Minimum Ceiling Attenuation Class (CAC): 40, determined in accordance with ASTM E1264.
h. Tile Edge: Square.
i. Color: White.
j. Suspension System: Exposed grid.
k. Products:
    1) CertainTeed Corporation; Vinylrock 1140-CRF-1: www.certainteed.com.
    2) National Gypsum; Gridstone #Gold Bond Gridstone GB5045: www.nationalgypsum.com
    3) USG Corporation; Sheetrock Brand Gypsum Lay-In, ClimaPlus, #3270: www.usg.com/ceilings.
l. Products:
    1) National Gypsum; Gridstone #GB5030: www.nationalgypsum.com.
    2) USG Corporation; Sheetrock Brand Lay-In Gypsum, ClimaPlus, #3200: www.usg.com/ceilings.

4. Acoustical Panels ACT 4: 2 mil (0.0508 mm) vinyl laminated to a gypsum core, sag resistant, USDA approved, low VOC with the following characteristics:
    a. Classification: ASTM E1264 Type XX.
    b. Size: 24 by 24 inches (610 by 610 mm).
    c. Fire Rating: Class A with Flame Spread Index of 5 or less and Smoke Developed Index of 0 when tested in accordance with ASTM 85.
    d. UL Listed Fire Rated Tile.
    e. Thickness: 1/2 inches (12.7 mm).
    f. Light Reflectance: 75 percent, determined in accordance with ASTM E1264.
    g. Ceiling Attenuation Class (CAC): 40, determined in accordance with ASTM E1264.
    h. Tile Edge: Square.
    i. Color: White.
    j. Suspension System: Exposed grid.
    k. Products:
        1) CertainTeed Corporation; Vinylrock 1142-CRF-1: www.certainteed.com.
        2) National Gypsum; Gridstone #GB5044: www.nationalgypsum.com.
        3) USG Corporation; Sheetrock Brand Gypsum Lay-In, ClimaPlus, #3260: www.usg.com/ceilings.
    l. Products:
        1) National Gypsum; Gridstone #GB5040: www.nationalgypsum.com.

5. Acoustical Panels ACT 5: Painted mineral fiber, sag and abuse resistant, anti-microbial, low VOC with the following characteristics:
    a. Classification: ASTM E1264 Type III.
    b. Size: 24 by 48 inch (610 by 1219 mm).
    c. Thickness: 3/4 inch (19 mm).
    d. Fire Rating: Class A with Flame Spread Index of 25 or less and Smoke Developed Index of 50 or less when tested in accordance with ASTM 85.
    e. UL Listed Fire Rated Tile.
    f. Minimum Light Reflectance: 82 percent, determined in accordance with ASTM E1264.
    g. Minimum NRC: 0.50, determined in accordance with ASTM E1264.
    h. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
    i. Panel Face: Scored with look of 8-12 x 12 inch (304.8 x 304.8 mm) tiles.
    j. Tile Edge: Tegular.
    k. Color: White.
    l. Suspension System: Exposed grid.
    m. Products:
        1) Armstrong World Industries, Inc; Fine Fissured Second Look #1760: www.armstrongceilings.com.
        2) CertainTeed Corporation; Baroque Customline BQCL-812: www.certainteed.com.

3) USG Corporation; Radar ClimaPlus Illusion Eight/Twelve #2852: www.usg.com/ceilings.

6. Acoustical Panels ACT 6: Painted mineral fiber, sag and abuse resistant, anti-microbial, low VOC with the following characteristics:
   a. Classification: ASTM E1264 Type III.
      1) Pattern: "A" - perforated, regularly spaced large holes.
   b. Size: 24 by 24 inches (610 by 610 mm).
   c. Thickness: 3/4 inch (19 mm).
   d. Fire Rating: Class A with Flame Spread Index of 25 or less and Smoke Developed Index of 50 or less when tested in accordance with ASTM 85.
   e. UL Listed Fire Rated Tile.
   f. Minimum Light Reflectance: 84 percent, determined in accordance with ASTM E1264.
   g. Minimum NRC: 0.60, determined in accordance with ASTM E1264.
   h. Minimum Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   i. Tile Edge: Tegular stepped.
      1) Joint: Kerfed and rabbeted.
   j. Color: White.
   k. Suspension System: Exposed grid.
   l. Products:
      1) Armstrong World Industries, Inc; Cirrus Profiles-Classic Step #591: www.armstrongceilings.com.
      2) CertainTeed Corporation; Cashmere Style Edge CMTS-124-1516: www.certainteed.com.
      3) USG Corporation; Luna Pedestals IV #R72716: www.usg.com/ceilings.
7. Acoustical Panels ACT 7: Painted ceramic bonded mineral fiber, sag and abuse resistant, anti-microbial, low VOC with the following characteristics:
   a. Classification: ASTM E1264 Type III.
   b. Size: 24 by 24 inches (610 by 610 mm).
   c. Size: 24 by 48 inch (610 by 1219 mm).
   d. Thickness: 5/8 inches (16 mm).
   e. Fire Rating: Class A with Flame Spread Index of 0 and Smoke Developed Index of 0 when tested in accordance with ASTM 85.
   f. UL Listed Fire Rated Tile.
   g. Minimum Light Reflectance: 79 percent, determined in accordance with ASTM E1264.
   h. Minimum NRC: 0.50, determined in accordance with ASTM E1264.
   i. Minimim Ceiling Attenuation Class (CAC): 38, determined in accordance with ASTM E1264.
   j. Tile Edge: Square.
   k. Color: White.
   l. Suspension System: Exposed grid.
   m. Products (24" X 24"):
      1) Armstrong World Industries, Inc; CERAMAGUARD Fine Fissured #607: www.armstrongceilings.com.
      2) USG Corporation; Radar Ceramic ClimaPlus #56644: www.usg.com/ceilings.
   n. Products (24" X 48"):
      1) Armstrong World Industries, Inc; CERAMAGUARD Fine Fissured #608: www.armstrongceilings.com.
      2) USG Corporation; Radar Ceramic ClimaPlus #56645: www.usg.com/ceilings.
8. Cementitious Acoustical Panels ACT 8: Aspen wood fibers bonded with inorganic hydraulic cement and backed with an acoustical backer, sag resistant, anti-microbial, low VOC with the following characteristics:
   a. Classification: ASTM E1264 Type XIV.
   b. Size: 24 by 24 inches (610 by 610 mm).
   c. Size: 24 by 48 inch (610 by 1219 mm).
   d. Thickness: 1 inches (25.4 mm).

e. Fire Rating: Class A with Flame Spread Index of 25 or less and Smoke Developed Index of 50 or less when tested in accordance with ASTM 85.
f. Minimum Light Reflectance: 75 percent, determined in accordance with ASTM E1264.
g. Minimum NRC: 0.85, determined in accordance with ASTM E1264.
h. Tile Edge: Square.
i. Color: White.
j. Color: Natural .
k. Color: See Interior Material Finish/Color Schedule on the Drawings.
l. Suspension System: Exposed grid.
m. Products (24" x 24"):
1) Armstrong World Industries, Inc; Tectum High NRC #5340W2L02T10: www.tectum.com.
n. Products (24" x 48"):
1) Armstrong World Industries, Inc; Tectum High NRC #5340W2L04T10: www.tectum.com.

C. Glued-up tiles.
1. Acoustical Panels ACT 9: Painted cast mineral fiber, abuse resistant, anti-microbial, low VOC with the following characteristics:
a. Classification: ASTM E1264 Type III.
b. Size: 12 by 12 inches (305 by 305 mm).
c. Thickness: 3/4 inch (19 mm).
d. Fire Rating: Class A with Flame Spread Index of 25 or less and Smike Developed Index of 50 or less when tested in accordance with ASTM 85.
e. Light Reflectance: 79 percent, determined in accordance with ASTM E1264.
f. NRC Range: 0.70, determined in accordance with ASTM E1264.
g. Ceiling Attenuation Class (CAC): 25, determined in accordance with ASTM E1264.
h. Tile Edge: Beveled.
1) Joint: Kerfed and rabbeted.
i. Color: White.
j. Adhesive: As recommended by manufacturer.
k. Products:
1) USG Corporation; "F" Fissured Basic Tile BESK #102: www.usg.com/ceilings.

D. Furnish extra materials equal to 1%, but not less than one box, of each acoustical material supplied. Provide materials in new, unopened cartons, labeled as to contents.

2.04 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
1. Materials:
a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
b. Aluminum Grid Cap: Aluminum sheet, ASTM B209/B209M.

C. Exposed Suspension System: HDG-30 steel, hot dipped galvanized body and cap.
1. Application(s): Non-rated ceiling systems.
2. Application(s): Fire-rated assemblies.
3. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
4. Profile: Tee; 15/16 inch (24 mm) face width.
5. Finish: Baked enamel.
6. Color: White.
7. Non- Fire Rated Products:
a. Armstrong World Industries, Inc; Prelude ML: www.armstrongceilings.com.
b. Rockfon/Chicago Metallic; 250 Snap-Grid System: www.rockfon.com.
c. USG Corporation; Donn Brand DX24 : www.usg.com/ceilings.
8. Fire Rated Products:
a. Armstrong World Industries, Inc; Prelude XL: www.armstrongceilings.com.

b. Rockfon/Chicago Metallic; 200 Snap-Grid System: www.rockfon.com.
c. USG Corporation; Donn Brand DX24 : www.usg.com/ceilings.

D. Exposed Suspension System: HDG-30 steel, hot dipped galvanized body and cap.
1. Application(s): Seismic, non-rated ceiling systems.
2. Application(s): Seismic and fire-rated assemblies.
3. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
4. Profile: Tee; 15/16 inch (24 mm) face width.
5. Finish: Baked enamel.
6. Color: White.
7. Non-Fire Rated Products:
a. Armstrong World Industries, Inc; Prelude ML: www.armstrongceilings.com.
b. Rockfon/Chicago Metallic; 1200 Seismic: www.rockfon.com.
c. USG Corporation; Donn Brand DX24: www.usg.com/ceilings.
8. Fire Rated Products:
a. Armstrong World Industries, Inc; Prelude XL: www.armstrongceilings.com.
b. Rockfon/Chicago Metallic; 1250 Seismic: www.rockfon.com.
c. USG Corporation; Donn Brand DX24: www.usg.com/ceilings.

E. Exposed Suspension System: HDG-60 steel, hot dipped galvanized body and aluminum cap.
1. Application(s): Fire-rated and non fire-rated kitchens, kitchen serving areas, toilets, and locker rooms..
2. Application(s): Fire-rated and non fire-rated with seismic in kitchens, kitchen serving areas, toilets, locker rooms.
3. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
4. Profile: Tee; 15/16 inch (24 mm) face width.
5. Finish: Baked enamel.
6. Color: White.
7. Products:
a. Armstrong World Industries, Inc; PRELUDE Plus XL Fire Guard: www.armstrongceilings.com.
b. Rockfon/Chicago Metallic; 1830: www.rockfon.com.
c. USG Corporation; Donn Brand-DXLA24: www.usg.com/ceilings.

F. Exposed Suspension System: HDG-30 steel, hot dipped galvanized body and cap.
1. Application(s): Non-rated ceiling systems.
2. Application(s): Fire-rated assemblies.
3. Application(s): Seismic and non-rated ceiling systems.
4. Application(s): Seismic and fire-rated assemblies.
5. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
6. Profile: Tee; 9/16 inch (14 mm) face width, stab end.
7. Finish: Baked enamel.
8. Color: White.
9. Non- Fire Rated Products:
a. Armstrong World Industries, Inc; Suprafine ML: www.armstrongceilings.com.
b. Armstrong World Industries, Inc; Suprafine XL: www.armstrongceilings.com.
c. Rockfon/Chicago Metallic; 4000 Tempra: www.rockfon.com.
d. USG Corporation; Donn Brand Centricitee DXT24: www.usg.com/ceilings.
10. Fire Rated Products:
a. Armstrong World Industries, Inc; Suprafine XL: www.armstrongceilings.com.
b. Rockfon/Chicago Metallic; 4050 Tempra: www.rockfon.com.
c. USG Corporation; Donn Brand Centricitee DXLT24: www.usg.com/ceilings.

2.05 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
C. Hold-Down Clips: Manufacturer's standard clips to suit application.
D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

E. Perimeter Moldings: Same metal and finish as grid.
   1. Size: As required for installation conditions and specified Seismic Design Category.
   2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

F. Metal Edge Trim for "Cloud or Transition Trim" Suspension Systems: Steel or extruded aluminum s noted below; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
   1. Steel Trim Height: 8 inch (203 mm) and less.
   2. Extruded Aluminum Trim Height: Over 8 inches (203 mm).
   3. Provide radius' as indicated on Reflected Ceiling Plans.
   4. Finish: Baked enamel.
   5. Color: Match ceiling grid.
   6. Products:
      a. Armstrong World Industries, Inc; AXIOM : www.armstrongceilings.com.
      b. Rockfon/Chicago Metallic; Infinity: www.rockfon.com.
      c. USG Corporation; Compasso: www.usg.com/ceilings.

G. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.
B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
C. Locate system on room axis according to Reflected Ceiling Plan.
D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
E. Suspension System: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
F. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch (19 mm) clearance between grid ends and wall.
G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
J. Do not eccentrically load system or induce rotation of runners.
K. Install light fixture boxes constructed of rated acoustical panel above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
C. Fit border trim neatly against abutting surfaces.
D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.
G. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door or in vestibules.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09 51 00

SECTION 09 65 00
RESILIENT FLOORING

TURN OFF VCT
TURN OFF LINOLEU
TURN OFF CHEMICAL RESISTANT
TURN OFF RUBBER
TURN OFF LVT
TURN OFF VINYL SHEET FLOORING
TURN OFF STAIR MATERIALS
TURN OFF VINYL THERMOPLASTIC BASE
TURN OFF RUBBER VULCANIZED THERMOSET BASE
TURN OFF RUBBER THERMOPLASTIC
TURN OFF RUBBER THERMOPLASTIC SCHULPTURED BASE
TURN OFF RESILIENT CHAIR RAIL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor preparation as specified in Section 09 05 61 - Common Work Results for Flooring Preparation:
   1. Substrate Prep and Patching.
   2. Porosity Inhibiting Admixture (PIA) in new slabs.
   3. Required Floor Flatness.
   4. Moisture Mitigation for Existing Slab on Grade.

B. Flooring types:
   1. Vinyl Composition Tile (VCT).
   2. Linoleum (LINO).
   3. Chemical Resistant Flooring (CRF).
   4. Rubber Flooring (RUB).
   5. Luxury Vinyl Tile and Planks (LVT)
   6. Vinyl Sheet Flooring (SV)

C. Resilient base.
   1. Base at freestanding or island casework.

D. Resilient stair accessories.

E. Installation accessories.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
   2. Provide data on substrate preparation materials.
      a. Materials for Substrate Prep and Patching.
      b. Visual Observation Report: For existing floor coverings to be removed.
      c. Epoxy Moisture Mitigation System Product Data: Manufacturer's published data on each product to be used for remediation.
         1) Manufacturer's qualification statement for training of Installer.
         2) Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

C. Shop Drawings: Indicate floor patterns.

D. Verification Samples: Submit two samples, 3 by 3 inch (76.2 by 76.2 mm) in size illustrating color and pattern for each resilient flooring product specified.

E. Sample warranties for specified products noted in Warranty Paragraph below.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Provide 1% of each type/color of flooring, trim and base used on the project in original packaging.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
B. Store all materials off of the floor in an acclimatized, weather-tight space.
C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
D. Protect roll materials from damage by storing on end.
E. Do not double stack pallets.

1.04 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.05 WARRANTY

A. Rubber Flooring:
   1. Manufacturer's standard 10 year warranty.
B. Integral Rubber treads/Risers:
   1. Manufacturer's standard 5 year warranty.
C. Linoleum:
   1. Manufacturer's standard 30 year warranty.
D. Chemical Resistant Flooring:
   1. Manufacturer's standard 10 year warranty.
E. Rubber Stair Tread:
   1. Manufacturer's standard 5 year warranty.
F. Vinyl Sheet Flooring:
   1. Manufacturer's standard 5 year warranty.
   2. Manufacturer's standard 10 year warranty.
   3. Manufacturer's standard 15 year warranty.
   4. Manufacturer's standard 20 year warranty.
G. Luxury Vinyl Tile and Plank
   1. Manufacturer's standard 10 year warranty.
   2. Manufacturer's standard 20 year warranty.
   3. Manufacturer's standard 25 year warranty.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers listed in this specification are approved under the following conditions:
   1. A manufacturer listed in both the specification and the Interior Material Finish/Color Schedule, on the Drawings is not required to submit a pre-bid approval.
   2. Manufacturers listed in this specification, but not in the Interior Material Finish/Color Schedule, on the Drawings shall submit color samples for pre-bid approval by addendum.
   3. When no colors are listed in the Interior Material Finish/Color Schedule, on the Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

2.02 SHEET FLOORING

A. Vinyl Sheet Flooring - Type SV #-1: Heterogeneous commercial flooring having a PUR reinforced wear layer composed of 90% binder content, with a polyurethane reinforced (PUR) construction with heat welded seams.
   1. Manufacturers:
      a. Mannington Commercial: www.manningtoncommercial.com.
      b. Tarkett Company: www.commercial.tarkett.com.
      c. Teknoflor: www.teknoflor.com.
      d. Shaw Contract: www.shawcontract.com.
      e. Johnsonite, a Tarkett Company: www.johnsonite.com.
   2. Minimum Requirements: Comply with ASTM F1303, Type II, with Class A fibrous backing.
   3. Static Load Resistance: 175 psi (1206 kPa) minimum, when tested as specified in ASTM F970.
   4. Seams: Heat welded.

5. Base: Integral flash cove base, 4 inches high with stainless steel or anodized aluminum top trim and aluminum cove reinforcement.
6. Base: Integral flash cove base, 6 inches high with stainless steel or anodized aluminum top trim and aluminum cove reinforcement.
7. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

B. Vinyl Sheet Flooring - Type SV #-2: Heterogeneous commercial flooring having a PUR reinforced wear layer composed of 90% binder content, with a polyurethane reinforced (PUR) construction with heat welded seams.
1. Manufacturers:
   a. Mannington Commercial: www.manningtoncommercial.com.
   b. Tarkett Company: www.commercial.tarkett.com.
   c. Teknoflor: www.teknoflor.com.
   d. Shaw Contract: www.shawcontract.com.
   e. Johnsonite, a Tarkett Company: www.johnsonite.com.
2. Minimum Requirements: Comply with ASTM F1303, Type II, with Class A fibrous backing.
3. Seams: Heat welded.
4. Base: Integral flash cove base, 4 inches high with stainless steel or anodized aluminum top trim and aluminum cove reinforcement.
5. Base: Integral flash cove base, 6 inches high with stainless steel or anodized aluminum top trim and aluminum cove reinforcement.
6. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

C. Chemical Resistant Vinyl Sheet Flooring - Type CRF #-1: An unbacked, nonlayered homogeneous sheet vinyl flooring protected by a diamond-infused UV-cured polyurethane finish.
1. Manufacturers:
   a. Armstrong Flooring, LLC; Mendintech with Diamond 10 Technology: www.armstrongflooring.com.
   b. Gerflor USA, Inc: www.gerflorusa.com.
   c. Teknoflor: www.teknoflor.com.
2. Minimum Requirements: Comply with ASTM F1913.
3. Total Thickness: 0.080 inch (2.0 mm) minimum.
4. Seams: Heat welded.
5. Base: Integral flash cove base, 4 inches high with stainless steel or anodized aluminum top trim and aluminum cove reinforcement..
6. Base: Integral flash cove base, 6 inches high with stainless steel or anodized aluminum top trim and aluminum cove reinforcement.
7. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

D. Rubber Sheet Flooring - Type RUB #-1: 100 percent rubber composition, color and pattern through total thickness.
1. Manufacturers:
   a. Burke Flooring, a Mannington Company: www.burkeflooring.com.
   b. Johnsonite, a Tarkett Company: www.johnsonite.com.
   c. Mondo Contract Flooring: www.mondocontractflooring.com.
   d. Nora by Interface: www.nora.com.
   e. Roppe Corporation: www.roppe.com.
2. Minimum Requirements: Comply with ASTM F1859, Type 1, without backing.
3. Thickness: 0.125 inch (3.2 mm) minimum.
4. Seams: Heat welded.
5. Seams: Chemically bonded using seam sealer.
6. Seams: Butted.
7. Surface Texture: Smooth.
8. Surface Texture: Raised circles.
9. Surface Texture: Raised squares.
10. Surface Texture: Hammered.

11. Surface Texture: Smooth.
12. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

E. Linoleum Sheet Flooring - Type LINO #-1: All natural ingredients, homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
1. Manufacturers:
   a. Armstrong World Industries, Inc: www.armstrong.com.
   b. Forbo Flooring, Inc: www.forboflooringna.com.
   c. Gerflor USA, Inc: www.gerflorusa.com.
   d. Johnsonite, a Tarkett Company: www.johnsonite.com.
2. Minimum Requirements: Comply with ASTM F2034, Type corresponding to type specified.
3. Environmental: 100% USDA Certified BioBased Product.
4. Backing: Natural jute.
5. Thickness: 0.100 inch (2.5 mm), minimum, excluding backing.
6. Seams: Heat welded.
7. Graphics: Water jetted graphics as noted on the Drawings.
8. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

F. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.03 TILE FLOORING

A. Vinyl Composition Tile - Type VCT #-1: Homogeneous, with color extending throughout thickness.
1. Manufacturers:
   a. Armstrong Flooring, Inc; Excelon Series: www.armstrongflooring.com.
   b. Tarkett Company; Tarkett VCT II Series: www.commercial.tarkett.com.
   c. Johnsonite, a Tarkett Company; Tarkett VCT Series: www.johnsonite.com.
2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
3. Size: 12 by 12 inch (305 by 305 mm).
4. Thickness: 0.125 inch (3.2 mm).
5. Collection/Color: See Material Finish/Color Schedule on the Drawings.

B. Vinyl Composition Tile - Type VCT #-2: Homogeneous, with color extending throughout thickness.
1. Manufacturers:
   a. Armstrong Flooring, Inc; Excelon Series: www.armstrongflooring.com.
   b. Tarkett Company; Tarkett VCT II Series: www.commercial.tarkett.com.
   c. Johnsonite, a Tarkett Company; Tarkett VCT Series: www.johnsonite.com.
2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
3. Size: 12 by 12 inch (305 by 305 mm).
4. Thickness: 0.125 inch (3.2 mm).
5. Collection/Color: See Material Finish/Color Schedule on the Drawings.

C. Resilient Feature Strips for Inlaid Basketball Striping: Homogeneous composition of polyvinyl chloride (PVC), additives and colorants.
1. Manufacturers:
   a. Tarkett Company; Tarkett Feature Strips: www.commercial.tarkett.com.
2. Styles: 1 inch (2.54 cm) wide x 1/8 inch (3.18 mm) thick feature strip with tipple like grout texture on one side and smooth surface on other side.
   a. Provide shapes as required to match striping on drawings.
3. Color: See Interior Material Finish/Color Schedule on the Drawings, or colors noted on the Drawings.

D. Luxury Vinyl Tile - Type LVT #-1: Solid vinyl with color and pattern throughout thickness.
1. Manufacturers:
   a. Adore Floors: www.adorefloors.com.
   b. Armstrong Flooring Inc: www.armstrong.com.
   c. Tarkett Company: www.commercial.tarkett.com.
   d. Gerflor USA: www.gerflorusa.com.
   e. Interface: www.interfrace.com
   f. LG Hausys America, Inc; : www.lghausysusa.com.

g. Karndean Design Flooring: www.karndean.com.
h. Mannington Commercial: www.manningtoncommercial.com.
i. Mohawk Group: www.mohawkgroup.com.
j. Shannon Specialty Floors, Inc: www.shannonspecialtyfloors.com.

2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
3. Square Tile Size: 12 by 12 inch (305 by 305 mm).
4. Plank Tile Size: 4 by 36 inch (102 by 914 mm).
5. Wearing surface: Embossed.
6. Wear Layer Thickness:
   a. 12 mil (0.31 mm).
   b. 20 mil (0.51 mm).
   c. 30 mil (0.76 mm).
7. Total Thickness:
   a. 2.00 mm (0.079 inch).
   b. 2.50 mm (0.098 inch).
   c. 3.00 mm (0.118 inch).
   d. 4.00 mm (0.158 inch).
   e. 4.50 mm (0.177 inch).
   f. 5.00 mm (0.197 inch).
   g. 6.00 mm (0.236 inch).
8. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

E. Rubber Tile - Type RUB#-1: Homogeneous, color and pattern throughout thickness.
1. Manufacturers:
   a. Johnsonite, a Tarkett Company: www.johnsonite.com.
   b. Nora by Interface: www.nora.com.
   c. Roppe Corporation: www.roppe.com.
2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
3. Smoke Density: Provide materials with smoke density of less than 450 when tested in accordance with ASTM E 662.
4. Size: 12 by 12 inch (305 by 305 mm) nominal.
5. Size: 18 by 18 inch (457 by 457 mm) nominal.
6. Size: 20 by 20 inch (508 by 508 mm) nominal.
7. Total Thickness: 0.125 inch (3.2 mm).
8. Texture: Smooth.
9. Texture: Raised circles.
10. Texture: Raised squares.
11. Texture: Hammered.
12. Texture: Embossed.
13. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

F. Rubber Tile - Type RUB#-2: Homogeneous, color and pattern throughout thickness.
1. Manufacturers:
   a. Burke Flooring: www.burkeflooring.com.
   b. Johnsonite, a Tarkett Company: www.johnsonite.com.
   c. Nora by Interface: www.nora.com.
   d. Roppe Corporation; Rubber Tile: www.roppe.com.
2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
3. Smoke Density: Provide materials with smoke density of less than 450 when tested in accordance with ASTM E 662.
4. Size: 12 by 12 inch (305 by 305 mm) nominal.
5. Size: 18 by 18 inch (457 by 457 mm) nominal.
6. Size: 20 by 20 inch (508 by 508 mm) nominal.
7. Total Thickness: 0.125 inch (3.2 mm).
8. Texture: Smooth.

9. Texture: Raised circles.
10. Texture: Raised squares.
11. Texture: Hammered.
12. Texture: Embossed.
13. Pattern/Color: See Material Finish/Color Schedule on the Drawings.

G. Linoleum Tile: - Type LINO #-1 All natural ingredients, homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
1. Manufacturers:
a. Armstrong World Industries, Inc: www.armstrong.com.
b. Forbo Flooring, Inc: www.forboflooringna.com:
c. Gerflor USA, Inc: www.gerflorusa.com.
d. Johnsonite, a Tarkett Company: www.johnsonite.com.
1) LINO Type #_____:Modular Tile 10 x 10 inch (25 x 25 cm); 10 x 20 inch (25 x 50 cm); 20 x 20 inch (50 x 50 cm); 10 x 40 inch (25 x 100 cm).
2) LINO Type #_____:MCT 13 x 13 inch (33 x 33 cm).
2. Minimum Requirements: Comply with ASTM F2195, Type corresponding to type specified.
3. Environmental: 100% USDA Certified BioBased Product.
4. Backing: Natural Jute.
5. Thickness: 0.100 inch (2.5 mm), minimum, excluding backing.
6. Seams: Heat Welded.
7. Collection/Pattern/Color: See Material Finish/Color Schedule on the Drawings.

2.04 STAIR COVERING

2.05 STAIR COVERING

A. Stair Treads with Integral Risers:
1. Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
2. Rubber; full height of riser, full width and depth of tread in maximum available widths; tapered thickness.
a. Manufacturers:
1) Johnsonite, a Tarkett Company; Angle Fit: www.johnsonite.com.
2) Nora by Interface: www.nora.com.
3) Roppe Corporation; Rubber Tread: www.roppe.com.
b. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
c. Nosing: Square.
d. Striping: 2 inch (24 mm) wide contrasting color abrasive strips.
e. Tread Texture: Smooth.
f. Tread Texture: Raised.
g. Tread Texture: Ribbed.
h. Tread Texture: Hammered.
i. Pattern/Color: See Material Finish/Color Schedule on the Drawings.

B. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
1. Nominal Thickness: 0.080 inch (2.0 mm).

2.06 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TV, vinyl, thermoplastic.
1. Manufacturers:
a. Johnsonite, a Tarkett Company: www.johnsonite.com.
b. Roppe Corporation: www.roppe.com.
2. Height: 2-1/2 inch (62 mm).
3. Height: 3 inch (75 mm).
4. Height: 4 inches (100 mm)
5. Height: 6 inch (150 mm).
6. Thickness: 0.125 inch (3.2 mm).
7. Finish: Matte.

8. Length: Roll.
9. Style: Straight at Carpet.
10. Style: Coved at Hard Surface Flooring.
11. Style: Coved.
12. Corners: Provide prefabricated interior and exterior corners.
13. Stringers at stairs: 10 inch (254 mm) high.
14. Color: See Material Finish/Color Schedule on the Drawings.

B. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset.
1. Manufacturers:
   a. Burke Flooring, A Mannington Company: www.burkeflooring.com.
   b. Johnsonite, a Tarkett Company: www.johnsonite.com.
   c. Roppe Corporation: www.roppe.com.
2. Height: 2-1/2 inch (62 mm).
3. Height: 3 inch (75 mm).
4. Height: 4 inch (100 mm).
5. Height: 6 inch (150 mm).
6. Thickness: 0.125 inch (3.2 mm).
7. Finish: Matte.
8. Length: Roll.
9. Style: Straight at Carpet.
10. Style: Coved at Hard Surface Flooring.
11. Style: Coved.
12. Corners: Provide prefabricated interior and exterior corners.
13. Stringers at stairs: 10 inch (254 mm) high.
14. Color: See Material Finish/Color Schedule on the Drawings.

C. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic.
1. Manufacturers:
   a. Armstrong Flooring, Inc: www.armstrongflooring.com.
   b. Burke Flooring, A Mannington Company: www.burkeflooring.com.
   c. Johnsonite, a Tarkett Company: www.johnsonite.com.
   d. Nora by Interface: www.nora.com.
   e. Roppe Corporation: www.roppe.com.
2. Height: 2-1/2 inch (62 mm).
3. Height: 3 inch (75 mm).
4. Height: 4 inch (100 mm).
5. Height: 4 inch (100 mm).
6. Thickness: 0.125 inch (3.2 mm).
7. Finish: Matte.
8. Length: 4 foot (1.2 m) sections.
9. Length: Roll.
10. Style: Straight at Carpet.
11. Style: Coved at Hard Surface Flooring.
12. Style: Coved.
13. Corners: Provide prefabricated interior and exterior corners.
14. Stringers at stairs: 10 inch (254 mm) high.
15. Color: See Material Finish/Color Schedule on the Drawings.

D. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic, sculptured.
1. Manufacturers:
   a. Armstrong Flooring, Inc: www.armstrongflooring.com.
   b. Burke Flooring, A Mannington Company: www.burkeflooring.com.
   c. Johnsonite, a Tarkett Company: www.johnsonite.com.
   d. Roppe Corporation: www.roppe.com.
2. Finish: Matte.

3. Length: Roll.
4. Corners: Provide prefabricated interior and exterior corners.
5. Style and Color: See Material Finish/Color Schedule on the Drawings.

2.07 RESILIENT CHAIR RAIL

A. Resilient Chair Rail: ASTM F1861, Type TP, rubber, thermoplastic, sculptured.
1. Manufacturers:
a. Johnsonite, a Tarkett Company: www.johnsonite.com.
2. Finish: Matte.
3. Corners: Provide prefabricated interior and exterior corners.
4. Style and Color: See Material Finish/Color Schedule on the Drawings.

2.08 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
B. Moldings, Transition and Edge Strips:
1. Manufacturers:
a. Match resilient base manufacturer.
2. Transition/Reducer strips:
a. Provide at all floor type transitions occurring at a door.
b. Provide at all floor type transitions occurring within a room not at a door.
c. Refer to accessories manufacturer for appropriate transition/reducer profile required for specified floor types.
d. Color: See Interior Material Finish/Color Schedule, on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
C. Contact the General Contractor or Construction Manager for corrections to deficiencies prior to proceeding.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.
B. Install in accordance with manufacturer's written instructions.
C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
1. Resilient Strips: Attach to substrate using adhesive.
E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
F. Install flooring in recessed floor access covers, maintaining floor pattern.
G. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
B. Seal seams by heat welding where indicated.
C. Chemically bond seams using seam sealer where indicated.
D. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.05 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

D. Install square tile grain to quarter turn pattern. Allow minimum 1/2 full size tile width at room or area perimeter.
E. Install square tile grain to run in same direction. Allow minimum 1/2 full size tile width at room or area perimeter.
F. Install plank tile with a random offset of at least 6 inches (152 mm) from adjacent rows.

3.06 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
B. Install base on solid backing. Bond tightly to wall and floor surfaces.
C. Scribe and fit to door frames and other interruptions.

3.07 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.
B. Install stringers configured tightly to stair profile.
C. Adhere over entire surface. Fit accurately and securely.

3.08 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean in accordance with manufacturer's written instructions.

3.09 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 65 00

SECTION 09 68 13
CARPET FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor preparation as specified in Section 09 05 61 - Common Work Results for Flooring Preparation :
   1. Substrate Prep and Patching.
   2. Porosity Inhibiting Admixture (PIA) in new slabs.
   3. ***A moisture test may allow the flooring to be installed, but moisture levels vary depending on the time of the year and the flooring could fail at a later date for the Owner, so Moisture Mitigation is the best way to protect future floor failures.***
   4. Moisture Mitigation for Existing Slab on Grade.

B. Carpet tile, fully adhered.

C. Installation accessories.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings:
   1. Indicate color and pattern layouts.

D. Samples: Submit two carpet samples minimum size of 12 inches (304.8 mm) square, illustrating color and pattern design for each carpet color selected.

E. Installer's Qualification Statement of Approval from the Manufacturer.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Provide 2% of each type/color of flooring, trim and base used on the project in original packaging.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum five years documented experience and approved by carpet tile manufacturer.

1.04 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carpet Tile:
   1. Shaw Contract: www.shawcontract.com.

2.02 CARPET TILE MATERIALS

A. Carpet Tile, Type CPT #1:
   1. Manufacturer:
      a. Shaw Contract: www.shawcontract.com.
   2. Tile Size: 24 inch by 24 inch (610 by 610 mm), nominal.
   3. Product/Collection/Pattern and Color: See Interior Material Finish/Color Schedule on the Drawings.

B. Carpet Tile, Type CPT #2:
   1. Manufacturer:
      a. Shaw Contract: www.shawcontract.com.
   2. Tile Size: 24 by 24 inch (610 by 610 mm), nominal.
   3. Product/Collection/Pattern and Color: See Interior Material Finish/Color Schedule on the Drawings.

C. Carpet Tile, Type CPT #3:
   1. Manufacturer:
      a. Shaw Contract: www.shawcontract.com.
   2. Tile Size: 9 by 36 inch (230 by 910 mm), nominal.
   3. Product/Collection/Pattern and Color: See Interior Material Finish/Color Schedule on the Drawings.

D. Carpet Tile, Type CPT #4:
   1. Manufacturer:

a. Shaw Contract: www.shawcontract.com.
2. Tile Size: 24 by 24 inch (610 by 610 mm), nominal.
3. Tile Size: ____by____ inch (____by____ mm), nominal.
4. Product/Collection/Pattern and Color: See Interior Material Finish/Color Schedule on the Drawings.

2.03 ACCESSORIES

A. Carpet Adhesive: As recommended by carpet manufacturer.
B. Moldings, Transition and Edge Strips:
1. Refer to the requirements of Section 09 65 00 - Resilient Flooring.
2. Transition/Reducer strips:
a. Provide at all floor type transitions occurring at a door.
b. Refer to accessories manufacturer for appropriate transition/reducer profile required for specified floor types.
c. ***SPECIFIER NOTE: Populate the schedule on the drawings.***
d. Color: See Interior Material Finish/Color Schedule, on the Drawings.
C. Wood Baseboard Trim:
D. Refer to the requirements of Section 06 41 00 Architectural Wood Casework and Trim.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
D. Contact the General Contractor or Construction Manager for corrections to deficiencies prior to proceeding.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.
B. Install carpet in accordance with manufacturer's instructions.
C. Blend carpet from different cartons to ensure minimal variation in color match.
D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
F. Locate change of color or pattern between rooms under door centerline.
G. Fully adhere carpet tile to substrate.
H. Trim carpet tile neatly at walls and around interruptions.
I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
B. Clean and vacuum carpet surfaces.

3.05 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized representative to train Owner’s maintenance personnel on proper cleaning techniques and seam and carpet maintenance.

END OF SECTION 09 68 13

SECTION 09 90 00
PAINTING AND COATING

TURN OFF EXTERIOR PAINTING
TURN OFF RENOVATION SURFACE PREP
TURN OFF INTERIOR CONCRETE
TURN OFF INTERIOR MASONRY
TURN OFF INTERIOR METAL
TURN OFF INTERIOR GALV. METAL
TURN OFF INTERIOR ALUMINUM
TURN OFF INTERIOR WOOD
TURN OFF INTERIOR DRYWALL
TURN OFF INTERIOR GREEN SCREEN PAINT
TURN OFF COTTON/CANVAS (PIPE INSUL)
TURN OFF PLASTER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Interior painting and coating systems.
C. Exterior painting and coating systems.
D. Scope:
    1. Finish surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
        a. Exterior:
            1) Concrete: Cementitious siding, Flexboard, Transite, non-roof shingles, common brick, stucco, tilt-up, precast, and poured-in-place cement.
            2) Masonry: Concrete masonry units (CMU), cinder or concrete block.
            3) Metal: Aluminum, galvanized.
            4) Metal, Miscellaneous: Iron, ornamental iron, structural iron and steel, ferrous metal.
            5) Wood: Siding, trim, shutters, sashes, and hardboard-bare/primed.
        b. Interior:
            1) Concrete, Walls and Ceilings: Poured concrete, precast concrete, unglazed brick, cement board, tilt-up, cast-in-place concrete, and plaster.
            2) Concrete Ceilings: Poured concrete, precast concrete, cement board, cast-in-place concrete, and plaster.
            3) Masonry (CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
            4) Metal: Aluminum.
            5) Metal, Galvanized: Ceilings and ductwork.
            6) Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.
            7) Wood: Walls, ceilings, and trim.
            8) Drywall: Walls, ceilings, gypsum board, and similar items.
            9) Cotton or Canvas pipe insulation.
            10) Plaster walls and ceilings.
            11) Field finishing of wood doors.
            12) Painting of interior and exterior surfaces of existing metal lockers, trim and sloped tops.
            13) Painted graphics and lettering as shown on drawings.
            14) Painting of plywood panels for technology equipment after the AHJ has verified that the proper fire-retardant plywood has been installed.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
    1. Product characteristics.
    2. Surface preparation instructions and recommendations.

3. Primer requirements and finish specification.
4. Storage and handling requirements and recommendations.
5. Application methods.
6. Clean-up information.

C. Samples: Submit four paper draw down samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

D. Maintenance Data: Submit coating maintenance manual including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Paint and Finish Materials: Unused/previously opened cans of paint, but not less than 1 gallon (4 L) of each color; from the same product run, store where directed.
2. Label each container with color in addition to manufacturer's label.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

B. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in “MPI Approved Products List.”
2. Preparation and Workmanship: Comply with requirements in “MPI Architectural Painting Specification Manual” for products and paint systems indicated.
3. Previously Painted Surface Preparation and Workmanship: Comply with requirements in “MPI Maintenance and Repainting Manual” for products and paint system indicated.

1.04 EXAMINATION OF DOCUMENTS

A. Examine the specifications for the work of other trade contractors and to become familiar with their work. All surfaces that are left unfinished by the requirements of other specifications to be finished by this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.

C. Paint Materials: Store at a minimum of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

D. Handling: Maintain a clean, dry storage area to prevent contamination or damage to materials.

1.06 FIELD CONDITIONS

A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.

B. Follow manufacturer's recommended procedures for producing the best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
1. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
2. Do not apply coatings during cold, rainy or frosty weather.
3. Do not apply to surfaces, which are exposed to hot sun.

C. The existing building may contain lead-containing materials, including paint. It is the Contractor's responsibility to meet all governmental regulations when dealing with and disposing of lead containing materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Products: Subject to compliance with requirements, provide products from one of the following manufacturers (all products are to be from the same manufacturer):
1. Sherwin-Williams Company: Noted as "S-W"; www.sherwin-williams.com.
2. PPG Paints: Noted as "PPG"; www.ppg.com.
3. Benjamin Moore & Company: Noted as "BM"; www.benjaminmoore.com.

B. Basis of Design for Specialty Products:

1. Rosco Laboratories: www.us.rosco.com.

2.02 PAINTINGS AND COATINGS

A. General:
   1. Provide factory/paint store-mixed coatings unless otherwise indicated.
   2. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site, or other method acceptable to authorities having jurisdiction.
         1) Flat Paints & Coatings, VOC content of not more than 50 g/L.
         2) Non-flat Paints & Coatings VOC content of not more than 150g/L.
         3) Primers, Sealers, and Undercoaters VOC Content of not more than 100 g/L
         4) Industrial Maintenance; to include Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
         5) Floor Coatings: VOC not more than 100 g/L.
         6) Shellacs, Clear: VOC not more than 730 g/L.
         7) Shellacs, Pigmented: VOC not more than 550 g/L.
         8) Stains, Interior: VOC not more than 250 g/L
         9) Varnishes; VOC not more than 275 g/L

C. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

2.03 PAINT SYSTEMS - EXTERIOR

A. Concrete: Cementitious siding, Flexboard, Transite, non-roof shingles, common brick, concrete masonry units (CMU), stucco, tilt-up, precast, and poured-in-place cement.
   1. Latex Systems:
      a. Satin Finish:
         1) 1st Coat:
            (a) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer LX02W50.
            (b) PPG Perma-Crete Acrylic Alkali Resistant Primer 4-603.
            (c) BM Fresh Start High hiding All Purpose Primer N046.
               (1) Minimum 8 mils dry.
         2) 1st Coat (Existing Surfaces):
            (a) Sherwin-Willaims Extreme Bond Interior/Exterior Bonding Primer B51W001150
            (b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
            (c) BM Stix Waterborne Bonding Primer SXA-110.
               (1) Minimum 0.9 mils dry.

B. Metal: Aluminum.
   1. Latex Systems:
      a. Gloss Finish:
         1) 1st Coat:
            (a) S-W Pro Industrial DTM Acrylic Primer/Finish B66W00011.
            (b) PPG Pitt-Tech Int/Ext Primer DTM, 90-712.
            (c) BM Ultra Spec 500 Interior 0 VOC Latex Primer N534
               (1) Minimum 2.5 mils dry.
         2) 1st Coat (Existing Surfaces):
            (a) Sherwin-Willaims Extreme Bond Interior/Exterior Bonding Primer B51W001150
            (b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
            (c) BM Stix Waterborne Bonding Primer SXA-110.
               (1) Minimum 0.9 mils dry.
         3) 2nd and 3rd Coats:

(a) S-W Pro Industrial Acrylic Gloss, B66-600 Series.
(b) PPG Manor Hall Interior/Exterior Gloss Acrylic Latex, 52-110.
(c) BM Ultra Spec Exterior Gloss N449.
(1) Minimum 1.3 mils dry per coat.

C. Zinc Coated Metal Metal: Flashing, Decking and Exposed Mechanical, including rooftop items.
1. Latex Systems:
a. Satin Finish:
1) Touch-up:
(a) S-W Pro Industrial DTM Acrylic Primer/Finish B66W00011.
(b) PPG Pitt-Tech Int/Ext Primer DTM, 90-712.
(c) BM Corotech Waterborne DTM Metal Primer/Finish V110.
(1) Minimum 2.5 mils dry.
2) 2nd and 3rd Coats:
(a) S-W A-100 Exterior Latex Satin A82-100 Series
(b) PPG Speedhide Exterior Satin 6-2045XI.
(c) BM Ultra Spec Exterior Satin N448.
(1) Minimum 1.3 mils dry per coat.

D. Zinc Coated Metal: Doors, Frames and Handrails.
1. Gloss Finish:
a. Touch-up:
1) S-W Pro Industrial DTM Acrylic Primer/Finish B66W00011.
2) PPG Pitt-Tech Int/Ext Primer DTM, 90-712.
3) BM Corotech Waterborne DTM Metal Primer/Finish V110.
(a) Minimum 2.5 mils dry.
b. 2nd and 3rd Coats:
1) S-W Pro Industrial Acrylic Gloss, B66-600 series
2) PPG Manor Hall Interior/Exterior Gloss Acrylic Latex, 52-110.
3) BM Ultra Spec Exterior Gloss N449.
4) Minimum 1.3 mils dry per coat.

E. Wood: Painted hardboard-bare/primed, wood trim, plywood.
1. Latex Systems:
a. Satin Finish:
1) 1st Coat:
(a) S-W Exterior Latex Wood Primer B42W08141
(b) PPG Speedhide Exterior Acrylic Wood Primer, 6-609.
(c) BM Fresh Start High hiding All Purpose Primer N046.
(1) Minimum 1.8 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Stix Waterborne Bonding Primer SXA-110.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coat:
(a) S-W A-100 Exterior Latex Satin A82-100 Series
(b) PPG Speedhide Exterior Satin 6-2045XI.
(c) BM Ultra Spec Exterior Satin N448.
(1) Minimum 1.3 mils dry per coat.

F. Wood: Semi-Transparent for Siding, Soffits, Fascia, Trim.
1. Stain, Water Reducible Systems:
a. Semi-Transparent:
1) 1st and 2nd Coat:
(a) S-W WoodScapes Exterior Polyurethane Semi-Transparent Stain, A15T00005.
(b) BM Arborcoat Semi-Transparent Deck & Siding Stain 638.

(1) Rough/porous: 100-200 sq ft/gal (2.5 to 4.9 sg m/l)
(2) Smooth: 350 sq ft/gal (8.6 sq m/l)

G. Wood: Solid Color for Siding, Soffits, Fascia, Trim.
1. Stain, Water Reducible Systems:
a. Solid Color:
1) 1st and 2nd Coat:
(a) S-W WoodScapes Exterior Acrylic Solid Color Stain, A15 Series.
(b) PPG Flood SWF Exterior Solid Wood Stain.
(c) BM Arborcoat Solid Deck & Siding Stain 640.
(1) 200 to 400 sq ft/gal (4.9 to 9.8 sq m/L).

2.04 PAINT SYSTEMS - INTERIOR

A. Concrete: Poured concrete, precast concrete, unglazed brick, cement board, tilt-up, cast-in-place concrete.
1. Latex Systems:
a. Eg-Shel Finish (Walls):
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 Series.
(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.
(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Stix Waterborne Bonding Primer SXA-110.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coats:
(a) S-W ProMar 200 0 VOC Interior Latex Eg-Shel, B20-2600 Series.
(b) PPG Speedhide Interior Eggshell 6-4310XI.
(c) BM Ultra Spec 500 Interior Eggshell 538.
(1) Minimum DFT: 1.5 per coat.
b. Flat Finish (Ceilings)
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 Series.
(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.
(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Stix Waterborne Bonding Primer SXA-110.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coats:
(a) S-W ProMar 200 0 VOC Interior Latex, B30-2600 Series.
(b) PPG Speedhide Interior Flat 6-4110XI.
(c) BM Ultra Spec 500 Interior Flat 536.
(1) Minimum 1.4 mils dry per coat.
2. Epoxy Systems, Solvent Based:
a. Gloss Finish (Scheduled on Drawings to Receive Epoxy on Shower Walls):
1) 1st Coat:
(a) S-W Macropoxy 646-100 Polyamide Epoxy
(b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
(c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
(1) Minimum 3.0 mils dry.
2) 1st Coat (Existing Surfaces):

(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum, 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Macropoxy 646-100 Polyamide Epoxy
(b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
(c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
(1) Minimum, 2.0 mils per coat.

3. Epoxy Systems, Water Based:
a. Eg-Shel/Low Luster Finish, Scheduled on Drawings to Receive Epoxy (Walls):
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 Series.
(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.
(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum, 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Water Based Catalyzed Epoxy Semi-Gloss B70 Series/B60V25
(b) S-W Pro Industrial WB Catalyzed Epoxy Eg-Shel or Gloss, B73-300 series
(c) PPG Pitt-Glaze WB. Epoxy Semi-Gloss, Series 16-551.
(d) BM Corotech Waterborne Amine Epoxy Gloss V440

b. Eg-Shel/Low Luster Finish-Single Component-Scheduled on Drawings to Receive Epoxy (Walls):
1) 1st Coat:
(a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
(b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum, 1.5 mils.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum, 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy (Eg-Shell K45)
(b) PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy
(c) BM Corotech High Performance Pre-Catalyzed Waterborne Epoxy Eggshell V342
(1) Minimum, 2.0 mils dry per coat.

B. Concrete (Contractor Option) New Ceilings: Poured concrete, precast concrete, cement board, cast-in-place concrete, and plaster.
1. Dryfall Waterborne Topcoats:
a. Eg-Shel Finish:
1) 1st and 2nd Coat:
(a) S-W Pro Industrial WB Acrylic Dryfall Eg-Shel, B42W00182
(b) PPG Speedhide Super Tech Flat-Eggshell 0-5 @60&85 Dry Fall, 6-725XI.
(c) BM Super Spec Sweep Up Flat Sheen 6@85, 153.
(1) Minimum 2.1 mils dry per coat.

C. Masonry (CMU): Concrete, split face, scored, smooth, high density, low density, and fluted.

1. Latex Systems:
    a. Eg-Shel/Satin Finish:
        1) 1st Coat:
            (a) S-W Pro Industrial HD Block Filler, B42W00150.
            (b) PPG Speedhide Int/Ext Masonry Block Filler, 6-7.
            (c) BM Corotech Acrylic Block Filler V114.
                (1) Minimum, 8.0 mils dry.
        2) 1st Coat: (Contractor Option due to Schedule Constraints)
            (a) S-W Loxon Concrete and Masonry Primer LX02W0050.
            (b) PPG Perma-Crete Acrylic Alkali Resistant Primer 4-603.
            (c) BM Fresh Start High hiding All Purpose Primer N046.
                (1) Minimum 8.0 mils dry.
        3) 1st Coat (Existing Surfaces):
            (a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
            (b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
            (c) BM Stix Waterborne Bonding Primer SXA-110.
                (1) Minimum 0.9 mils dry.
        4) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Eg-Shel, B20-2600 Series.
            (a) Sherwin-Williams ProMar 200 Zero VOC Eg-Shel, B20-2600 Series.
            (b) PPG Speedhide Interior Eggshell 6-4310XI.
            (c) BM Ultra Spec 500 Interior Eggshell 538.
                (1) Minimum 1.5 mils dry per coat.
2. Epoxy Systems, Solvent Based:
    a. Gloss Finish (Scheduled on Drawings to Receive Epoxy in Showers):
        1) 1st Coat:
            (a) S-W Macropoxy 646-100 Polyamide Epoxy
            (b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
            (c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
                (1) Minimum 2.0 mils per coat.
        2) 1st Coat (Existing Surfaces):
            (a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
            (b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
            (c) BM Fresh Start High Hiding All Purpose Primer N046.
                (1) Minimum 0.9 mils dry.
        3) 2nd and 3rd Coat:
            (a) S-W Macropoxy 646-100 Polyamide Epoxy
            (b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
            (c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
                (1) Minimum 2.0 mils per coat.
3. Epoxy systems, Water Based:
    a. Eg-Shel/Low Luster Finish, Scheduled on Drawings to Receive Epoxy (Walls):
        1) 1st Coat:
            (a) S-W Pro Industrial HD Block Filler, B42W00150.
            (b) PPG Speedhide Int/Ext Masonry Block Filler, 6-7.
            (c) BM Corotech Acrylic Block Filler V114.
                (1) Minimum 8.0 mils dry.
        2) 1st Coat (Existing Surfaces):
            (a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
            (b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
            (c) BM Fresh Start High Hiding All Purpose Primer N046.
                (1) Minimum 0.9 mils dry.
        3) 2nd and 3rd Coat:
            (a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy (Eg-Shell K45)

(b) PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy
(c) BM Corotech High Performance Pre-Catalyzed Waterborne Epoxy Eggshell V342
(1) Minimum 2.0 mils dry per coat.

b. Eg-Shel/Low Luster Finish-Single Component-Scheduled on Drawings to Receive Epoxy (Walls):
1) 1st Coat:
(a) S-W Pro Industrial HD Block Filler, B42W00150.
(b) PPG Speedhide Int/Ext Masonry Block Filler, 6-7.
(c) BM Corotech Acrylic Block Filler V114.
(1) Minimum 8.0 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coat:
(a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy (Eg-Shell K45)
(b) PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy
(c) BM Corotech High Performance Pre-Catalyzed Waterborne Epoxy Eggshell V342
(d) Minimum 2.0 mils dry per coat.

D. Metal: Ferrous, Zinc Coated (not scheduled for epoxy, except for Showers). HM Doors and Frames, Handrails, Miscellaneous metals.
1. Alkyd Systems, Water Based - Electrostatic Painting of Existing Lockers
a. Gloss Finish:
1) 1st Coat:
(a) S-W Kem Kromik Universal Metal Primer
(b) PPG Speedhide Zinc Chromate Metal Primer, 6-204.
(1) Minimum 1.5 mils dry.
2) 2nd and 3rd Coats:
(a) S-W P&M Industrial Alkyd Gloss Enamel, B54-100 Series
(b) PPG Pitt-Tech Plus DTM Gloss, 90-912
(1) Minimum 2.0 mils dry per coat.
2. Epoxy Systems, Water Based:
a. Gloss Finish: Scheduled on Drawings for Epoxy on Shower Walls:
1) Touch-up:
(a) S-W Macropoxy 646-100 Polyamide Epoxy
(b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
(c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
(1) Minimum 2 mils dry.
2) 2nd and 3rd Coat:
(a) S-W Macropoxy 646-100 Polyamide Epoxy
(b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
(c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
(1) Minimum 2.0 mils per coat.

b. Semi-Gloss Finish:
1) Touch-up:
(a) S-W Pro Industrial DTM Acrylic Primer/Finish B66W00011.
(b) PPG Pitt-Tech Int/Ext Primer DTM, 90-712.
(c) BM Corotech Waterborne DTM Metal Primer/Finish V110.
(1) Minimum 2 mils dry.
2) 1st Coat: (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.

(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45/46-150 Series.
(b) PPG PITT-GLAZE WB1 Interior Semi-Gloss Pre-Catalyzed Water-Borne Acrylic Epoxy.
(c) BM Corotech WB Pre-Cat Epoxy Coating Semi-Gloss V341.
(d) Minimum 1.3 mils dry per coat.

E. Metal, Galvanized: Exposed Overhead, Ceilings and ductwork.
1. Dryfall Waterborne Topcoats:
a. Eg-Shel Finish:
1) Touch-up:
(a) S-W Pro Industrial DTM Acrylic Primer/Finish B66W00011.
(b) PPG Pitt-Tech Int/Ext Primer DTM, 90-712.
(c) BM Corotech Waterborne DTM Metal Primer/Finish V110.
(1) Minimum 2 mils dry.

2) 1st and 2nd Coat:
(a) S-W Pro Industrial Waterborne Acrylic Dryfall, B42-82 Series.
(b) PPG Speedhide Super Tech Flat-Eggshell 0-5 @60&85 Dry Fall, 6-725XI.
(c) BM Super Spec Sweep Up Flat Sheen 6@85, 153.
(d) Minimum 2.1 mils dry per coat.

F. Aluminum-Mill Finish:
1. Latex Systems:
a. Semi-Gloss High Performance:
1) 1st Coat:
(a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
(b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 1.3 mils dry.

2) 1st Coat: (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W ProMar 200 0 VOC Interior Latex Eg-Shel, B20-2600 Series.
(b) PPG Speedhide Interior Eggshell 6-4310XI.
(c) BM Ultra Spec 500 Interior Eggshell 538.
(1) Minimum 1.3 mils dry per coat.

2. Epoxy Systems, Water Based:
a. Gloss Finish-Scheduled on Drawings as Epoxy in Showers:
1) 1st Coat:
(a) S-W DTM Wash Primer B71Y1
(b) PPG Multi Prime Epoxy Primer, 94-109.
(c) BM Corotech Waterborne Bonding Primer V175.
(1) Minimum 0.7 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Macropoxy 646-100 Polyamide Epoxy

(b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
(c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
(1) Minimum 2.0 mils dry per coat.

b. Eg-Shel/Low Luster Finish, Scheduled on Drawings to Receive Epoxy (Walls):
1) 1st Coat:
(a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
(b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 1.3 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coat:
(a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy (Eg-Shell K45)
(b) PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy
(c) BM Corotech High Performance Pre-Catalyzed Waterborne Epoxy Eggshell V342
(1) Minimum 2.0 mils dry per coat.

c. Eg-Shel/Low Luster Finish-Single Component-Scheduled on Drawings to Receive Epoxy (Walls):
1) 1st Coat:
(a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
(b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 1.3 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coat:
(a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy (Eg-Shell K45)
(b) PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy
(c) BM Corotech High Performance Pre-Catalyzed Waterborne Epoxy Eggshell V342
(1) Minimum 2.0 mils dry per coat.

G. Wood:
1. Latex Systems (Painted- Walls, ceilings and trim):
a. Eg-Shel/Satin Finish:
1) 1st Coat:
(a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
(b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 1.5 mils dry.
2) 2nd and 3rd Coat:
(a) S-W ProMar 200 0 VOC Interior Latex Eg-Shel, B20-2600 Series.
(b) PPG Speedhide Interior Eggshell 6-4310XI.
(c) BM Ultra Spec 500 Interior Eggshell 538.
(1) Minimum 1.3 mils dry per coat.
2. Stain and Varnish System (Wood-Transparent Finish):
a. Satin Finish:
1) 1st Coat:
(a) S-W Minwax Performance Series Tintable Wood Stain 250 VOC.

(b) PPG Deft Interior Oil Wood Stain.
(c) BM Lenmar QuickStain Alkyd Wiping Stain
(1) Spreading Rate: As needed to match architect's sample.

2) 2nd and 3rd Coat:
(a) S-W Minwax Polycrylic finish.
(b) PPG Deft Polyurethane Interior Satin.
(c) BM Benwood Stays Clear Polyurethane Satin N423.
(1) Minimum 1 mil dry per coat.

H. Drywall:

1. Latex Systems:

a. Eg-Shel Finish (Walls and similar items):

1) 1st Coat:
(a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
(b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 1.5 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W ProMar 200 Zero VOC Eg-Shel, B20-2600 Series.
(b) PPG Speedhide Interior Eggshell 6-4310XI.
(c) BM Ultra Spec 500 Interior Eggshell 538.
(1) Minumim 1.5 mils dry per coat.

b. Flat Finish (Soffits/Ceilings):

1) 1st Coat:
(a) S-W ProMar 200 Zero VOC Interior Latex Primer, B28W02600.
(b) PPG .SpeedHide Zero VOC Interior Latex Primer, 6-4900XI
(c) BM Ultra Spec 500 Interior 0 VOC Latex Primer N534
(1) Minimum 1.5 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W ProMar 200 0 VOC Interior Latex, B30-2600 Series.
(b) PPG Speedhide Interior Flat 6-4110XI.
(c) BM Ultra Spec 500 Interior Flat 536.
(1) Minimu 1.4 mils dry per coat.

c. Flat primer: Surfaces Scheduled to Receive Vinyl Wallcovering, Wall Fabric or Tackable Wallcovering:

1) 1st Coat:
(a) S-W Multi-Purpose Interior/Exterior Latex Primer B51W450.
(b) PPG Seal Grip Acrylic Universal Primer, 17-921.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 1.5 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.

(1) Minimum 0.9 mils dry.

3) 2nd Coat on Existing Surfaces:
   (a) S-W Multi-Purpose Interior/Exterior Latex Primer B51W450.
   (b) PPG Seal Grip Acrylic Universal Primer, 17-921.
   (c) BM Fresh Start High Hiding All Purpose Primer N046.
      (1) Minimum 1.5 mils dry per coat.

2. Epoxy Systems, Water Based:
   a. Gloss Finish:
      1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600: www.sherwin-williams.com/#sle.
         (a) 4 mils wet, 1.5 mils dry per coat.
      2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series: www.sherwin-williams.com/#sle.
         (a) 5 mils wet, 2 mils dry per coat.
   b. Semi-Gloss Finish-Two Component- Scheduled on Drawings to Receive Epoxy (Walls and similar items):
      1) 1st Coat:
         (a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
         (b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
         (c) BM Fresh Start High Hiding All Purpose Primer N046.
            (1) Minimum 1.5 mils dry.
      2) 1st Coat (Existing Surfaces):
         (a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
         (b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
         (c) BM Fresh Start High Hiding All Purpose Primer N046.
            (1) Minimum 0.9 mils dry.
      3) 2nd and 3rd Coat:
         (a) S-W Water Based Catalyzed Epoxy B70 Series/B60V25 OR S-W Pro Industrial WB Catalyzed Epoxy Eg-Shel or Gloss, B73-300 series
         (b) PPG Pitt-Glaze WB. Epoxy Semi-Gloss, Series 16-551.
         (c) BM Corotech Waterborne Amine Epoxy Gloss V440.
            (1) Minimum 2.0 mils dry per coat.
   c. Eg-Shel/Low Luster Finish-Single Component-Scheduled on Drawings to Receive Epoxy (Walls and similar items):
      1) 1st Coat:
         (a) S-W Multi Purpose Latex Primer / Sealer B51-450 Series
         (b) PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
         (c) BM Fresh Start High Hiding All Purpose Primer N046.
            (1) Minimum 1.5 mils dry.
      2) 1st Coat (Existing Surfaces):
         (a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
         (b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
         (c) BM Fresh Start High Hiding All Purpose Primer N046.
            (1) Minimum 0.9 mils dry.
      3) 2nd and 3rd Coat:
         (a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy (Eg-Shell K45)
         (b) PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy
         (c) BM Corotech High Performance Pre-Catalyzed Waterborne Epoxy Eggshell V342
            (1) Minimum 2.0 mils dry per coat.
      4) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series: www.sherwin-williams.com/#sle.

I. Specialty Systems over Drywall: Video Screen Walls:
   1. Latex Systems:

a. Ultra Flat:
1) 1st Coat:
(a) S-W ProMar 200 Zero VOC Interior Latex Primer, B28W02600.
(b) PPG SpeedHide Zero VOC Interior Latex Primer, 6-4900XI
(c) BM Ultra Spec 500 Interior 0 VOC Latex Primer N534
(1) Minimum 1.5 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coat:
(a) Rosco DigiComp HD Green, 150 05710 Series.
(1) Minimum 2 mil dry per coat.

J. Cotton or Canvas Covering Over Insulation (except exposed overhead work):
1. Latex Systems:
a. Flat finish:
1) 1st Coat:
(a) S-W ProMar 200 Zero VOC Interior Latex Primer, B28W02600.
(b) PPG SpeedHide Zero VOC Interior Latex Primer, 6-4900XI
(c) BM Ultra Spec 500 Interior 0 VOC Latex Primer N534
(1) Minimum 1.5 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coat:
(a) S-W ProMar 200 0 VOC Interior Latex, B30-2600 Series.
(b) PPG Speedhide Interior Flat 6-4110XI.
(c) BM Ultra Spec 500 Interior Flat 536.
(1) Minimum 1.4 mils dry per coat.

K. Plaster
1. Latex Systems:
a. Eg-Shel Finish (Walls and similar items):
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 Series.
(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.
(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.
2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Stix Waterborne Bonding Primer SXA-110.
(1) Minimum 0.9 mils dry.
3) 2nd and 3rd Coat:
(a) S-W ProMar 200 Zero VOC Eg-Shel, B20-2600 Series.
(b) PPG Speedhide Interior Eggshell 6-4310XI.
(c) BM Ultra Spec 500 Interior Eggshell 538.
(1) Minumim 1.5 mils dry per coat.
b. Flat Finish (Soffits/Ceilings):
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 Series.

(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.
(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Stix Waterborne Bonding Primer SXA-110.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W ProMar 200 0 VOC Interior Latex, B30-2600 Series.
(b) PPG Speedhide Interior Flat 6-4110XI.
(c) BM Ultra Spec 500 Interior Flat 536.
(1) Minimum 1.4 mils dry per coat.

2. Epoxy Systems, Water Based:
a. Gloss Finish: Scheduled on Drawings for Epoxy on Shower Walls:
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer LX02W0050.
(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.
(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.

2) 1st Coat: (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHILED MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Macropoxy 646-100 Polyamide Epoxy
(b) PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
(c) BM Corotech Polyamide Epoxy Coating Gloss V400-62.
(1) Minimum 2.0 mils per coat.

b. Semi-Gloss Finish-Two Component- Scheduled on Drawings to Receive Epoxy (Walls and similar items):
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 Series.
(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.
(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Water Based Catalyzed Epoxy B70 Series/B60V25 OR S-W Pro Industrial WB Catalyzed Epoxy Eg-Shel or Gloss, B73-300 series
(b) PPG Pitt-Glaze WB. Epoxy Semi-Gloss, Series 16-551.
(c) BM Corotech Waterborne Amine Epoxy Gloss V440.
(1) Minimun 2.0 mils dry per coat.

c. Eg-Shel/Low Luster Finish-Single Component-Scheduled on Drawings to Receive Epoxy (Walls and similar items):
1) 1st Coat:
(a) S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 Series.
(b) PPG Perma-Crete Int/Ext Alkali Resistant Primer, 4-603.

(c) BM Super Spec High Building Masonry Primer N068.
(1) Minimum 3.0 mils dry.

2) 1st Coat (Existing Surfaces):
(a) S-W Extreme Bond Interior/Exterior Bonding Primer B51W001150
(b) PPG ACRI-SHIELD MAX Exterior Latex Bonding Primer.
(c) BM Fresh Start High Hiding All Purpose Primer N046.
(1) Minimum 0.9 mils dry.

3) 2nd and 3rd Coat:
(a) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy (Eg-Shell K45)
(b) PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Waterborne Acrylic Epoxy
(c) BM Corotech High Performance Pre-Catalyzed Waterborne Epoxy Eggshell V342
(1) Minimum 2.0 mils dry per coat.

2.05 EXTRA STOCK

A. Provide left over paint with Owner for touch-up purposes. At completion of project, provide one complete set of drawdowns in each maintenance manual with a schedule noting the locations each paint color was used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
C. Test shop-applied primer for compatibility with subsequent cover materials.
D. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
E. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent
2. Masonry: 12 percent
3. Wood: 15 percent
4. Gypsum Board: 12 percent
5. Plaster: 12 percent

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove mildew from impervious surfaces by scrubbing with solution of water and bleach. Rinse with clean water and allow surface to dry.
D. Formed and Precast Concrete:
1. Remove release agents including form oil, curing compounds, dirt, laitance, loose cement, efflorescence, chalk and leftover residue from precast manufacturing process per paint manufacturer's recommendations.
2. Fill bug holes, air pockets, and other voids with cement patching compound.
3. Prepare concrete according to SSPC-SP 13.
4. Previously painted surfaces must be free of grease, oil, wax or any other contaminants and loose or flaking paint. Clean concrete of oil and grease with detergent, hot water and vigorous scrubbing. All loose and peeling paint must be scraped or sand blasted back to sound adhesion.
E. Masonry: Remove efflorescence and chalk. After prime coat is dry, fill remaining small holes, cracks and other defects with Swedish putty made by mixing dry spackle with prime paint.
1. Previously painted masonry surfaces must be dry, clean and free of dust, dirt and any other contaminants. Hard glossy surfaces are to be lightly sanded or dulled with deglosser/cleaner. Surfaces in poor condition must be prepared for repainting by removing loose paint and blisters by scraping, sanding or burning. Paint in these areas are to be removed at least 12 inches beyond the failing area. Patch all holes left after removal of nails, screws, and anchors. Prime before applying finish coats.

F. Cementitious Siding: Remove dirt, dust and other foreign matter. Pressure clean, if needed, to remove grease, oil, and loose particles.

G. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.
   1. Previously painted gypsum wallboards must be completely dry, smooth-sanded, clean and free of dust, dirt, powdery residue, grease, oil, wax or any other contaminants such as flaking or peeling paint before paint application is started. Treat or remove all contaminants and correct defects. Dull glossy old paint by light sanding or with a commercial deglosser/cleaner to assure maximum adhesion of the new coating. Patch holes and cracks with a latex patching compound, sand smooth and spot prime with the paint or enamel to be used as the final coat.

H. Plaster: Fill hairline cracks, small holes, and imperfections with patching plaster. Make smooth and flush with adjacent surfaces. Treat textured, soft, porous, or powdery surfaces in accordance with manufacturer's instructions.
   1. Previously painted plaster surfaces must be dry, clean, and free of dust, dirt, powder residue, grease, oil, wax or any other contaminants; free of flaking, crumbling or chalking conditions before paint application is started. Contaminants must be treated or removed. Defects corrected as necessary. Dull glossy old paints by light sanding or with deglosser/cleaner to assure maximum adhesion of the new coating. Remove any loose, chipped, peeling or blistered old paint by scraping and smooth sanding. If highly porous old paint needs reconditioning before receiving the new application, prime the entire surface with undercoater oil primer. Patch holes and cracks with latex patching compound per manufacturer’s instructions after removing plaster as far back as necessary to reach firm areas. Spot prime patched areas with sealer-primer.

I. Aluminum: Remove surface contamination and oil; wash with solvent according to SSPC-SP 1.
   1. All chipped, peeling or blistered paint must be removed by hand or power tool cleaning. Remove all oil, grease, dirt or other foreign materials. Remove excessive chalking or sanding. Remove any mildew present by scrubbing with detergent and bleach. Thoroughly clean surface with water prior to repainting.

J. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.
   3. Previously painted metal must be dry, clean and free of contaminants. Hard and glossy surfaces are to be sanded lightly or dulled with deglosser/cleaner. Remove peeling, loose, chipped, and blistered paint and rust by scraping and sanding. Prime all sanded areas and areas devoid of paint with an all-purpose metal primer.

K. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended by paint manufacturer and blast cleaning according to SSPC-SP 6. Protect from corrosion until coated.
   4. Previously painted metal must be dry, clean and free of contaminants. Hard and glossy surfaces are to be sanded lightly or dulled with deglosser/cleaner. Remove peeling, loose, chipped, and blistered paint and rust by scraping and sanding. Prime all sanded areas and areas devoid of paint with an all-purpose metal primer.

L. Wood: Remove dust, grit, and foreign matter. Scrape, sand, and spot prime knots and pitch streaks. Fill nail holes and imperfections with wood filler and sand smooth.
   1. Previously painted surfaces must be free of dirt, mildew, loose paint, etc. Excessive chalking or dirt must be removed by washing with water. Hard glossy surfaces are to be lightly sanded or dulled with deglosser/cleaner. Openings permitting entrance of water should be caulked prior to painting. Surfaces in poor condition must be prepared for repainting by removing loose paint and blisters by scraping, sanding or burning. Paint in these areas is to be removed at least 12 inches beyond the failing area. Prime before applying finish coats.

3.03 SCHEDULE OF EXTERIOR WORK

A. General: Do not paint brick, stucco, precast concrete, prefinished aluminum, sealant (unless scheduled to receive paint).
B. New Work: Paint or finish all other new, unfinished, primed and factory painted surfaces, including all rooftop mechanical equipment, screen louvers, wall louvers (not factory-finished), miscellaneous metals, steel and galvanized steel lintels.
C. Existing Work: Prepare and paint all surfaces as noted on the drawings.

3.04 SCHEDULE OF INTERIOR WORK

A. General
1. Paint complete all surfaces noted with a "PT" on Room Finish Schedule.
a. New Work: In rooms with surfaces not scheduled for paint on Room Finish Schedule, paint hollow metal doors and frames, metal stairs and railings as occur.
b. Existing Areas:
1) Paint all items covered by notes on the drawings.
2) Remodeling work: In rooms with surfaces scheduled for paint on Room Finish Schedule, paint hollow metal doors and frames, metal stairs and railings as occur.
3) In unscheduled areas where patching has occurred, paint all walls corner to corner and floor to ceiling. Match adjacent wall color. Paint both sides of doors and frames at locations where replacement or modifications have been made.
c. Provide specified finish on exposed surfaces including, but not limited to the following:
1) Prime coated mechanical units, piping, pipe covering, sprinkler piping, interior duct surfaces visible behind grilles, tanks without factory finish, radiation covers, cabinet unit heaters, exposed ductwork, louvers and grilles.
2) Electrical panel box covers and surface raceways (over factory finish), conduits and boxes and all factory primed electrical equipment. (Except in maintenance, service and electrical rooms).
3) Hollow metal doors and frames, steel stairs, ladders and railings, catwalks and safety mesh grilles, access panels, prime painted hardware, painted astragals and vision lite kits on doors, coiling grilles and doors (unless factory finished), metal supports for counters and exposed miscellaneous metals.
4) Plywood backboards for electrical panels/devices and low voltage. Primer. Color white or to match adjacent wall surface, two coats on unistrut mounted backboards. Cover all sides and within cutout areas. Mask the fire-retardant rating stamp on each sheet prior to priming and painting. Leave the stamps exposed and visible.
d. Do not paint sealant.
e. DO NOT paint low voltage Category rated (Cat5, Cat6, Cat6A) cabling, as it voids the warranty.
f. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
g. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
h. Paint exposed ceiling areas visible around edges of "clouds".

3.05 APPLICATION

A. Conditions
1. Do no work when surface, coating product, air temperature, humidity or dewpoint does not meet requirements of PROJECT CONDITIONS in Part 1 of this specification or manufacturers recommendations.
2. Do no interior work until building is properly enclosed.
3. Do work under adequate illumination and dust-free conditions.
B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
C. Apply products in accordance with manufacturer's written instructions.
D. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.
E. Regardless of number of coats specified, apply additional coats until complete hide is achieved.

F. Paint finish in food service areas to have an "orange peel" finish.

3.06 PRIMING

A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
   1. Tint prime and under coats being used under highly pigmented paint, approximately 1/2 to 3/4 depth of final color.

B. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to top coat manufacturers.

3.07 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

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.

3.08 FIELD QUALITY CONTROL

A. Testing and Painting Application: Owner reserves the right to test DFT of painted surfaces.

B. If testing discovers that DFT of installed paint does not meet specification, the Contractor will pay for initial and final testing and recoat surfaces until testing agency confirms specification is met.

3.09 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 90 00

SECTION 10 11 00
VISUAL DISPLAY BOARDS

TURN OFF GLASS MARKERBOARDS
TURN OFF TACKBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.
B. Glass markerboards.
C. Tackboards.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's data on chalkboard, porcelain enamel steel markerboard, glass markerboard, tackboard, trim, and accessories.
C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
D. Samples: Two, 2 by 2 inches (50 by 50 mm) in size illustrating materials and finish, color and texture of :
   1. Markerboard
   2. Tackboard.
   3. Glass markerboard.
E. Manufacturer's Approval of Installer.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
B. Do not install visual display surfaces until spaces are enclosed and weather tight, surfaces are complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
C. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide manufacturers lifetime warranty for markerboard surfaces to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Markerboard Surfaces:
B. Claridge Products and Equipment, Inc; ____: www.claridgeproducts.com/#sle.
C. MooreCo, Inc; ____: www.moorecoinc.com/#sle.
D. Nelson Adams NACO; ____: www.nelsonadamsnaco.com/#sle.
E. Polyvision Corporation; e3 environmental ceramic steel surface: www.polyvision.com.
F. Equivalent products by other manufacturers are acceptable.
G. Manufacturers/Fabricators of Visual Display Boards that meet the requirements of the specification are acceptable.

2.02 VISUAL DISPLAY UNITS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Surface consisting of enameling grade cold rolled steel manufactured from a minimum of 30 percent post-consumer and post-industrial waste, 0.016 inch, 28 gauge (0.4064 mm) thick for all preframed boards without joints. All face sheets shall be 0.025 inch, 24 gauge (0.635 mm) thick for boards with spline joints and have the same content as 0.016 inch, 28 gauge (0.4064 mm) thick face sheets.
   2. All enameling grade steel shall be coated with a coating process that exhibit the following characteristics:
      a. All coatings shall contain less than a combined total of less than 0.1 percent of heavy metal cadmium, mercury, hexavalent chromium, and lead.
      b. All coatings shall be free of arsenic and antimony as well as volatile organic compounds.

c. Writing surface face sheet shall be 99 percent recyclable.
d. Free of orange peel.
e. Facing sheet coatings:
1) 1.7-2.5 mils enameled ground coat on face minimum thickness.
2) 3.0-4.0 mils enameled cover (color) coat for markerboard.
3) 1.7-2.5 mils enameled minimum ground coat on back of facing.
4) Firing temperatures shall be 1475-1500 degrees minimum.

3. Color:
a. White.
b. Finish gloss:
1) High gloss.

4. Backing: Aluminum foil, laminated to core.

B. Tackboards: Linoleum tackable surface, laminated to core.

C. Manufacturing:
1. Markerboard Core: Particleboard, 1/2 inch thick (13 mm thick) or gypsum board 1/2 inch (13 mm) thick laminated to face sheet with factory machine type only.
a. Maximum panel length of 16 feet (4.8768 m).
b. All particleboard joints/seams shall be equipped with continuous steel splines routed into the core to assure alignment of writing surfaces joined in the same plane.
2. Tackboard Core:
a. Fiberboard, gypsum board, or hardboard, 1/4 inch (6.35 mm) thick laminated to covering with factory machine type only.
3. Size: As indicated on drawings.
4. Perimeter Trim: Extruded aluminum, with concealed fasteners.
a. 0.062 inch (1.5748 mm) thick, ± 1/2 inch (12.7 mm) narrow profile, securely fastened with resin coated staples at the rear of the unit.
b. Trim shall be supplied with corners mitered to a hairline joint.
c. Spline trim for full height markerboards: Manufacturers standard aluminum spline/spline clip.
5. Frame Finish: Anodized, natural.
6. Attachment devices:
a. Adjustable slotted wall brackets (zinc plated).
b. Attachment screws (for bracket attachment to boards).
7. Accessories:
a. Provide marker tray, full width, blade tray, 2-3/4 inch (69.85 mm).

D. NonmagneticGlass Markerboards: Back-coated glass.
1. Glass: Laminated, low iron, 1/4 inch thick (6 mm thick), with bevel edges and radiused corners, laminated to steel backing sheet for use with magnets. Coated or treated for use as dry erase board or projection surface.
2. Glass Finish: Frosted.
3. Size: As indicated on drawings.
4. Length: 42 inches (1067 mm), in one piece.
5. Frame: No frame, with concealed fasteners.
6. Mounting: Concealed Z clips.
7. Accessories: Provide magnetic marker tray and magnetic marker holder.
8. Manufacturers:
a. Egan Visual Corporation; Egan Visual GlassBoards: www.egan.com.
b. Equivalent products by other manufacturers are acceptable.

2.03 MATERIALS

A. Aluminum: Type 6063 alloy grade aluminum with T5 tempering treatment and shall receive type 2010R1 anodized finish.
1. Trim shall be free of raw or ground edges, and untreated or uncoated edges.
2. Trim shall be 99 percent recyclable.

B. Float Glass: Provide float-glass-based glazing unless otherwise indicated.

C. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).
D. Gypsum Board: ASTM C1396/C1396M, paper/foil faced, plain type.
E. Fiber Board: ASTM C208, cellulosic fiber board.
F. Adhesives: Specifically formulated environmentally friendly adhesives containing no volatile organic compounds.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.
C. Check surface conditions to assure they are:
   1. Free from dust dirt or scaling paint.
   2. Free from projections or depressions that affect smooth finished surfaces of boards.
D. Verify flat wall surface for frameless adhesive-applied boards.
E. Notify General Contractor or Construction Manager for correction of deficiences.
   1. Do not proceed with installation until deficiencies are corrected.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.
B. Secure units level and plumb.

3.04 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.
B. Replace damaged and stained units that cannot be cleaned, at no additional cost to Owner.

END OF SECTION 10 11 00

SECTION 10 14 19
DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

D. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

C. Store tape adhesive at a normal room temperature of 68 to 72 degrees F (20 to 22 degrees C).

1.04 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dimensional Letter Signs:

1. Any fabricator that meets the intent of the specification is acceptable.

2.02 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 DIMENSIONAL LETTERS

A. Applications: In locations as noted on the drawings.

1. Use individual letters.
2. Mounting Location: Exterior as indicated on drawings.

B. ***SPECIFIER NOTE: Keep below for metal letters.***

C. Metal Letters:

1. Material:
   a. Stainless steel sheet, fabricated reverse channel
   b. Stainless steel sheet, formed
   c. Stainless steel sheet, flat
   d. Aluminum casting
   e. Aluminum sheet, fabricated reverse channel
   f. Aluminum sheet, flat
2. Thickness: 1/8 inch minimum (3 mm).
3. Letter Height: As indicated on drawings.
4. Text and Typeface:
   a. Character Font:
      1) As noted on the drawings.
   b. Character Case:
      1) Match character case indicated on the drawings.
5. Finish:
   a. Brushed, satin.
   b. As selected by Architect from manufacturer's full range.
6. Mounting: Concealed screws.

D. Interior Plastic Letters:

1. Material:
    a. Injection molded plastic
    b. Acrylic plastic sheet, flat
    c. Vinyl sheet, flat cutout
2. Thickness: 1/8 inch minimum (3 mm).
3. Letter Height: As indicated on drawings.
4. Text and Typeface:
    a. Character Font:
        1) Helvetica, Arial, or other sans serif font
        2) Times or other serif font
        3) As indicated on the drawings.
    b. Character Case:
        1) Upper case only.
        2) Lower case only.
        3) Upper and lower case (title case).
        4) Match character case indicated on the drawings.
5. Finish: As selected by Architect from manufacturer's full range.
6. Mounting:
    a. Concealed or exposed screws.
    b. Tape adhesive.
    c. Silicone.
    d. Concealed screws.

2.04 FINISHES

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

B. Surface preparation: Follow paint manufacturer's instructions for preparing surfaces before applying primers or graphics.

C. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related appearance, provide custom color matches as selected by the Architect.

D. Aluminum: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
    1. Class 1, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin)
    2. Chemical Finish: etched, medium matte, Anodic Coating: Architectural Class 1, clear coating 0.018 mm (or thicker) complying with AAMA 611.

E. Powder-coated Finish: Manufacturer's standard polyester based powder-coating over recommended primer complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

F. Colors and Sheen: High gloss color not limited to manufacturer's standard colors.

G. Exterior color(s): _____

H. Color(s): See Interior Material Finish/Color Schedule on Architectural Drawings.

2.05 MATERIALS

A. Metals:
    1. General: For the fabrication of exposed metal work, use only materials, which are smooth and free of surface blemishes including pitting, roughness, seam marks, roller marks, and trade names. Do not use materials that have stains or discolorations.
    2. Provide stretcher leveled standard of flatness.
    3. Aluminum Sheet and Plate: ASTM B 209 (ASTM 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.
    4. Aluminum Extrusions: ASTM B 221 (ASTN B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 6063-T5.

B. Plastic:

1. General: Plastic shall be free of imperfections from forming or fabrication. All surfaces shall be free from scratches and shall be cleaned and polished per manufacturer's instructions at completion of installation. Edges shall be flame polished, free of saw marks and chips, and be eased, unless otherwise noted.
2. Monolithic Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA, (UV absorbing), of thickness indicated, with Finish 1 (smooth or polished finish).
    a. Transparent: Provide colorless sheet with visible light transmittance of 92 percent measured per ASTM D 1003.
    b. Translucent: Provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.
    c. Opaque: Provide colors and finishes indicated or, if not indicated, as selected by Architect from manufacture's full range.
3. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for application intended.

2.06 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.
B. Exposed Screws: Stainless steel.
C. Tape Adhesive: Double-sided tape, permanent adhesive.
D. Silicone: 100%.
E. Electrical Components and Devices: Listed and labeled as defined in NFPA 70 by a qualified testing agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
B. Notify General Contractor or Construction Manager if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install with horizontal edges level.
C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
D. Protect from damage until substantial completion; repair or replace damaged items.

END OF SECTION 10 14 19

SECTION 10 14 23
PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.
   1. Room Identifications signs.
   2. Interior directional and informational signs.
   3. Signage for Storm Shleters.
B. Vinyl signage.
C. Exterior directional signs.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
C. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
   2. Show locations of electrical service connections.
   3. Include diagrams for power, signal, and control wiring.
   4. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
      a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
      b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
      c. Submit for approval by Owner through Architect prior to fabrication.
D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
E. Verification Samples: Submit samples showing colors, materials, and finishes specified.
F. Manufacturer's qualification statement.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
B. Professional Engineer Qualifications for Exterior Signage (not attached to the building): A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for design and installations of signs, and miscellaneous support that are similar to those indicated for this project in material, design and extent.
C. Storm Shelter Signage: Shall comply with ICC 500 Standard for the Design and construction of Storm Shelters, Section 504 where applicable.
   1. Characters and graphics, including but not limited to, copy height, letter stroke, symbols, materials, and finishes indicated on the Drawings are intended as guidelines for compliance. Should conflicts arise, notify the Architect before proceeding.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.
C. Store under cover and elevated above grade.
D. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
B. Maintain minimum ambient temperature during and after installation.

C. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop drawings.
D. Establish Dimensions: Where field measurements cannot be made without delaying the Work, establish sign dimensions and proceed with fabrication without field measurements. Coordinate fabrication with construction progress to avoid delay.
E. Installation: Coordinate installation with Owner. For signs supported by or anchored to permanent construction, coordinate specific requirements for types and placement of anchorage devices and similar items to be used for attaching signs.
F. For signs supported by or anchored to permanent construction, furnish templates for installation of blocking, anchorage devices, and electrical conduits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Any fabricator that meets the intent of the specification is acceptable.
B. Vinyl Film:
1. Gerber Technologies as manufactured by 3M: www.gerber tcechnologies.com.

2.02 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 PANEL SIGNAGE

A. Panel Signage:
1. Application:
a. Room and door signs.
2. Description: Flat signs with non-glare matte finish photopolymer raised letter panel media.
3. Sign Size: As indicated on drawings.
4. Total Thickness: 1/8 inch (3 mm) with exterior grade polymide resin sign face.
5. Sign Edges:
a.
b. Squared
c. Bevelled
d. Radiused
6. Corners:
a. Squared
b. Radiused
c. Bevelled
7. Color and Font, unless otherwise indicated:
a. Character Font:
1) Helvetica, Arial, or other sans serif font
2) Times or other serif font
3) _____
b. Character Case:
1) Upper and lower case (title case)
2) Upper case only
3) Lower case only
c. Background Color: See Interior Material Finish Schedule on the Drawings..
d. Character Color: Contrasting color.
8. Profile: Flat panel without frame.
9. Profile: Flat panel in aluminum frame.
a. Frame Finish:
1) Black anodized
2) Natural (clear) anodized
3) Painted to match sign face.

4) Frame Finish: See Interior Material Finish/Color Schedule on the Drawings.

10. Tactile Letters: Raised 1/32 inch minimum.
11. Braille: Grade II, ADA-compliant.
12. One-Sided Wall Mounting: Tape adhesive and silicone.
13. One-sided Wall Mounting: Concealed screws.
14. Glass Mounting of One-sided signs

B. Directional wall mounted and overhead signage media:
1. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
2. Sign Color: Clear.
3. Total Thickness: 1/8 inch (3 mm).

2.04 SIGNAGE APPLICATIONS

A. Room and Door Signs:
1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings.
a. Provide "window" section for replaceable occupant name.
2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section with sliding "In Use/Vacant" indicator.
3. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.

B. Interior Directional and Informational Panel Signs:
1. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.
2. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color to match sign face, attached with screws in predrilled mounting holes, set in clear silicone sealant.

2.05 NON-ILLUMINATED DIRECTORIES

A. Non-illuminated Directories: Provide a surface mounted, non-illuminated directory consisting of a cabinet with operable transparent cover, and a retainer frame containing a header panel and a letter board or removable message strips. Graphics for message strips, header panels, and other designs shall be in the letter style, size, spacing, and arrangement indicated.

B. Cabinet Housing: Provide perimeter cabinet frame fabricated from aluminum extrusions of the profile indicated, mitered and welded with an aluminum-sheet rear cover panel. Provide structural reinforcement to prevent racking and misalignment.

C. Reveal-Type Frame and Nonsectional Cover Design: 1/4-inch thick tempered glass in an extruded-aluminum frame. Mount cover frame on concealed hinges to form a reveal between the outer edge of the cover frame and the inner edge of perimeter cabinet frame.

D. Changeable-Letter-Type Header Strips: Black-vinyl-covered strips, of size indicated, grooved to receive changeable letters.

E. Changeable-Letter Boards: Grooved changeable-letter boards with black-vinyl-covered surface, fabricated on removable plywood back. Space grooves at 1/4-inches (6.4 mm) o.c. to receive changeable letters.

F. Letters: Molded-plastic letters with tabs for engaging grooves in the letter board or message strip. Provide manufacturer’s boxed letter assortment of not less than 200 letters for each letter size, style, color, and case required.

2.06 VINYL GRAPHICS

A. High performance cast vinyl for printing and vinyl cutting for interior and exterior applications including glazing and wall surfaces.

B. Solid Color Vinyl Film:
1. Vinyl and Adhesive Thickness: 2.5 to 3.5 mil (0.063 to 0.09 mm).
2. Finish: Gloss.
3. Finish: Matte.
4. Color(s): See Drawings and/or Interior Material Finish/Color Schedule on the Drawings.
5. Products:
a. Gerber Technologies: 220 High Performance; www.gerbertechnologies.com.

C. Translucent Vinyl:

1. Vinyl and Adhesive Thickness: 2.0 to 3.0 mil (0.0 to 0.0 mm).

D. Color(s): See Drawings and/or Interior Material Finish/Color Schedule on the Drawings.
   1. Products:
      a. Gerber Technologies: 230 Translucent; www.gerbertechnologies.com.

E. Reflective Vinyl Film:
   1. Vinyl and Adhesive Thickness: 7 to 8 mil (0.18 to 0.20 mm).
   2. Color(s): See Drawings and/or Interior Material Finish/Color Schedule on the Drawings.
   3. Products:
      a. Gerber Technologies: 280 Reflective; www.gerbertechnologies.com.

2.07 EXTERIOR DIRECTIONAL SIGNAGE

A. Free standing signs with aluminum posts set in concrete footings and flat panel aluminum faces with vinyl lettering.
   1. Posts: 3 x 3 inch (76.2 x 76.2 mm), 1/4 inch (6.35 mm) wall. Height as indicated on the drawings.
   2. Face panels: 1/4 inch (6.35 mm) with internal siffiners as required to meet wind load requirements.
   3. Install face panels flush with each face of the tube and with a 1/2 inch (12.7 mm) reveal.

B. Height and width of face panels as detailed on the drawings.
   1. Finish:
      a. Anodized.
      b. Clear.
      c. Light bronze.
      d. Medium bronze.
      e. Dark Bronze.
      f. Black.
      g. Champagne.
      h. Painted.
         1) Color: _____
   2. Concrete foundations: Refer to Section 03 30 00, Concrete for requirements.

2.08 FINISHES

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

B. Preparation: Substrates shall be smooth, clean and free of dust, grease, fingerprints, or other foreign matter. If necessary to obtain true color application, surface shall be "primed" with white before final color application is applied. Artwork shall be accurately reproduced with all edges straight and true and all finishes smooth with no visible imperfections.
   1. Surface preparation: Follow paint manufacturer's instructions for preparing surfaces before applying primers or graphics.

C. Corrosion Protection: Coat concealed surfaces, which will be in contact with concrete, stone, masonry, wood, or dissimilar metals, in exterior work and work to be built into exterior and below grade walls and decks, with a heavy coat of bituminous paint. Do not extend coating onto exposed surfaces.

D. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related appearance, provide custom color matches as selected by the Architect.

E. Aluminum: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
   1. Class 1, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin)
   2. Chemical Finish: etched, medium matte, Anodic Coating: Architectural Class 1, clear coating 0.018 mm (or thicker) complying with AAMA 611.
   3. Powder-coated Finish: Manufacturer's standard polyester based powder-coating over recommended primer complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
   4. Silkscreen: Use fast drying opaque enamel silkscreen ink.
   5. Colors and Sheen: High gloss color not limited to manufacturer's standard colors.
      a. Interior Color(s): See Interior Material Finish/Color Schedule on Architectural Drawings.

2.09 MATERIALS

A. Metals:
   1. General: For the fabrication of exposed metal work, use only materials, which are smooth and free of surface blemishes including pitting, roughness, seam marks, roller marks, and trade names. Do not use materials that have stains or discolorations.
      a. Provide stretcher leveled standard of flatness.

B. Aluminum Sheet and Plate: ASTM B 209 (ASTM 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.
   1. Thickness: Provide aluminum sheets and plates in sizes specified or indicated on the Drawings.
   2. Aluminum Extrusions: ASTM B 221 (ASTN B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 6063-T5.

C. Plastic:
   1. General: Plastic shall be free of imperfections from forming or fabrication. All surfaces shall be free from scratches and shall be cleaned and polished per manufacturer's instructions at completion of installation. Edges shall be flame polished, free of saw marks and chips, and be eased, unless otherwise noted.
   2. Monolithic Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA, (UV absorbing), of thickness indicated, with Finish 1 (smooth or polished finish).
      a. Transparent: Provide colorless sheet with visible light transmittance of 92 percent measured per ASTM D 1003.
      b. Translucent: Provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.
      c. Opaque: Provide colors and finishes indicated or, if not indicated, as selected by Architect from manufacture's full range.
      d. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for application intended.

2.10 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.
B. Exposed Screws: Stainless steel.
C. Silicone: 100%.
D. Tape Adhesive: Double-sided tape, permanent adhesive.
   1. Product: 3M: Very High Bond (VHB) Foam Double Face Tape; www.3M.com.
E. Electrical Components and Devices: Listed and labeled as defined in NFPA 70 by a qualified testing agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
B. Verify that power and data service is correctly sized and located to accommodate panel signs.
C. Notify General Contractor or Construction Manager if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install with horizontal edges level.
C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1 and localBuilding Codes.
D. Protect from damage until substant; repair or replace damaged items.

END OF SECTION 10 14 23

SECTION 10 28 00
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.
B. Utility room accessories.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work to receive anchor attachments with the placement of:
   1. internal wall reinforcement with Section 09 21 16 Gypsum Wallboard Assemblies.
   2. concealed ceiling supports with Section 05 50 00 Miscellaneous Metals or Section 09 21 16 Gypsum Board Wallboard Assemblies.
   3. wood blocking with Section 06 10 53 Rough Carpentry-Wood Blocking.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
C. Product Schedule: Provide a spreadsheet indicating rooms to receive accessories and quantities of each accessory in the room. Include items provided by the Owner and installed by the Contractor.

1.04 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage or frame corrosion defects within specified warranty period.
   1. Warranty Period: 15 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. Bobrick; www.bobrick.com.
   2. Bradley Corporation: www.bradleycorp.com.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
B. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
C. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.
D. Dispensing Accessories: Fully loaded and in operating condition at time of completion.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.
B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser (TPH): Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
   1. Products:
      a. Bobrick model B-274.
      b. Bradley model 5241.
B. Toilet Paper Dispenser (TPH): Supplied by Owner, installed by Contractor.
C. Paper Towel Dispenser (PTD), surface mounted: Supplied by Owner, installed by Contractor.
D. Soap Dispenser (SD): Supplied by Owner, installed by Contractor.
E. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick select plate glass.
   1. Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Frame: 3/4 x 3/4 inch (19 x 19 mm)angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   3. Backing: Full-mirror sized, galvanized steel sheet and nonabsorptive filler material.
      a. MIR # 1: 24 x 36 inches (609.6 x 914.4 mm).

1) Bobrick B-290 2436.
2) Bradley 780-2436.

b. MIR # 2: 36 x 36 inches (914.4 x 914.4 mm).
1) Bobrick B-290 3636 (Custom Size).
2) Bradley 780-3636 (Custom Size).

c. MIR # 3: 48 x 24 inches (1219.2 x 609.6 mm).
1) Bobrick B-290 4824.
2) Bradley 780-4824 (Custom Size).

d. MIR # 4: 60 x 24 inches (1524 x 609.6 mm).
1) Bobrick B-290 6024.
2) Bradley 780-6024.

e. MIR # 5: 72 x 24 inches (1828.8 x 609.6 mm).
1) Bobrick B-290 7224.
2) Bradley 780-7224 (Custom Size).

F. Grab Bars: Stainless steel, slip-resistant surface.
1. Standard Duty Grab Bars:
a. Support capacity: 900 pounds (408 kg), minimum.
b. Dimensions: 1-1/2 inch (38 mm) outside diameter, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration (Contractor to field verify conditions for sizes).
1) GB # 1 (Used for Toilet Sidewall):
(a) Bobrick B-6806 x 42" (horizontal) and B-6806 x 18" (vertical).
(b) Bradley 812002- 42 (horizontal) and 812002-18 (vertical).
2) GB # 2 (Used for Toilet Backwall):
(a) Bobrick B6806 x 36".
(b) Bradley 812002-36.
3) GB # 3 (Used for 36" x 36" Shower -Vertical Sidewall):
(a) Bobrick B6806 x 18".
(b) Bradley 812002-18.
4) GB # 4 (Used for Child Toilet Backwall):
(a) Bobrick B6806 x 24".
(b) Bradley 812002-24.
5) GB # 5 (Used for 36" x 36" Shower - Horizontal):
(a) Bobrick B6861- Two Walled 16" x 31" (Custom Size).
(b) Bradley 812058/059 - Two Walled 16" x 31" (Custom Size).
6) GB # 6 (Used for 36" x 60" Shower - Side and Back wall):
(a) Bobrick B6806 x 30" (Sidewall) and B6806 x 48" (Backwall).
(b) Bradley 812002-30 (Sidewall) and B812002-48 (Backwall).

G. Toiletry Shelf (provide one for every toilet stall or room):
1. Fixed, 0.05 inch (1.2 mm) satin-finished stainless steel, with 3/4 inch (19.05 mm) edge at shelf front and sides. Shelf shall be minimum 5 inches (127 mm) deep. Two 0.05 inch (1.2 mm) satin-finished stainless steel brackets.
2. Products:
a. Bobrick B-295 x 16.
b. Bradley 755 x 16.

H. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. SNR # 1:
a. Bobrick B-270 ConturaSeries.
b. Bradley 4A10 Diplomat.

I. Sanitary Napkin Disposal Unit: Stainless steel, back-to-back partition mounting with adjustable flanges, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable

receptacle.

1. SNR # 2:
    a. Bobrick B-4354 ConturaSeries.
    b. Bradley 4A11 Diplomat.

J. Sanitary Napkin Disposal Unit: Stainless steel, recessed, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

1. SNR # 3:
    a. Bobrick B-4353 ConturaSeries.
    b. Bradley 4A00 Diplomat.

2.05 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder (MH) (install one in each janitor closet directly above janitor sink/basin):

1. 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 3/4 inch (19.05 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
2. Hooks: Four, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
4. Length: 34 inches (863.6 mm).
5. Products:
    a. Bobrick B-239.
    b. Bradley 9933.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. For electrically-operated accessories, coordinate electrical power requirements and locations with on site electrician.
D. Verify that field measurements are as indicated on drawings.
E. Coordinate installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings with Section 06 10 53 and multiple studs at grab bars, wall mounted benches and baby changing stations with Section 09 21 16.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 28 00

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

TURN OFF AED CABINETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers noted as "FE" on the Drawings.
B. Fire blankets noted as "FB" on the Drawings.
C. Fire extinguisher cabinets and or brackets.
D. AED cabinets.
E. Accessories.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide extinguisher operational features and extinguisher ratings and classifications.
C. Shop Drawings: Indicate locations of cabinets, locations of individual fire extinquishers, and fire blankets, standpipe cabinets and AED cabinets. Indicate types of fire extinguishers at each location.

1.03 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
   2. Equivalent products by other manufacturers are acceptable.
B. Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
   2. Equivalent products by other manufacturers are acceptable.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
B. Refer to Fire Extinguisher Type / Mounting Schedule in Part 3 of this specification.
C. Multipurpose Dry Chemical Type Fire Extinguishers: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
   1. Class: A:B:C type.
   2. Size: 5 pound (2.27 kg).
      a. Model: JL Industries Cosmic 5E, 3A-40BC.
   3. Size: 10 pound (4.54 kg).
      a. Model: JL Industires Cosmic 10E, 4A-80BC
   4. Size and classification as scheduled be.
   5. Finish: Baked polyester powder coat, red color.
   6. Minimum Temperature: Minus 65 degrees F (Minus 54 degrees C).
D. Wet Chemical Type Fire Extinguishers: Stainless steel cylinder with protective nozzle tip orifice seal and nonmetallic nozzle tip finger guard, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin, and upright squeeze grip.
   1. Class: K type.
   2. Size: 1.8 gallons (6.8137 L).
   3. Size and classification as scheduled.
   4. Finish: Polished stainless steel.
   5. Temperature range: Minus 20 degrees F (Minus 29 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
B. Refer to Fire Extinguisher Type / Mounting Schedule in Part 3 of this specification.
C. Non Fire-Rated Cabinet Construction: Semi-Recessed.
   1. Formed aluminum with 3 inch (76.2 mm) rolled edge and continuous hinged door.

2. Vertical narrow acrylic glazed door with lettering.
3. Model for Multipurpose Dry Chemical Fire Extinguishers:
    a. JL Industries Academy 1029V10.
4. Model for Wet Chemical Fire Extinguishers:
    a. JL Industries Academy 2029V10.

D. Fire Rated Cabinet Construction: Fire rating as indicated on Code Plans.
1. Steel; outer and inner boxes fire barrier material.
2. Cabinet Configuration: Semi-recessed
    a. Formed aluminum with 2-1/2 inch (63.5 mm) or 3 inch (76.2 mm) rolled edge and continuous hinged door.
    b. Vertical narrow acrylic glazed door with lettering.
    c. Model for Multipurpose Dry Chemical Fire Extinguishers:
        1) JL Industries Academy 1027V10.
    d. Model for Wet Chemical Fire Extinguishers:
        1) JL Industries Academy 2027V10.

E. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.
F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
H. Finish of Cabinet Interior: Powder coated white.

2.04 AUTOMATED EXTERNAL DEFIBRILLATORS

A. AED Cabinets: Semi-recessed with 2-1/2 inch (63.5 mm) rolled edge aluminum trim, keyed switch alarm.
1. Full glazed door with continuous hinge, zinc plated pull handle and silkscreened red AED lettering and graphic.
2. Size: 17-3/8 inch (441.325 mm) square x 6-3/4 inch (171.45 mm) deep.
3. Theft deterrent 85 db alarm and keyed switch.
4. Finish: Clear anodized.
5. Provide fire rated tubs for cabinets in rated walls. Fire rating as indicated on the Code Plans.
6. Model: JL Industires Lifestart 1427G12

2.05 ACCESSORIES

A. Fire Blanket/Cabinet: Fire retardant treated wool/synthetic, 62 by 80 inch (1574.8 by 2032 mm) x 2.75 pound (1.2474 kg) size.
B. Extinguisher Brackets: Formed steel, powder coated red with chrome strap.
C. Cabinet Lettering:
1. Fire Extinguisher:“FIRE EXTINGUISHER” decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and level in wall openings, as noted on the drawings.
C. Secure rigidly in place.
D. Place extinguishers in cabinets and on wall brackets.

3.03 FIRE EXTINGUISHER TYPE / MOUNTING SCHEDULE

	APPLICATION	FIRE EXTINGUISHER TYPE/MOUNTING
A.	Public Occupied Space	Multipurpose Dry Chemical [10 lb] (4.54 kg) in Cabinet
B.	Food Preparation Areas	Wet Chemical [1.8 gal] (6.8137 L) in Cabinet
	1. With grease fying equipment.	
C.	Food Preparation Areas	Multipurpose Dry Chemical [10 lb] (4.54 kg) in Cabinet
	1. Without grease fying equipment.	
D.	Public Occupied Shops	Multipurpose Dry Chemical [5 lb] (2.27 kg) on Bracket

1. Wood, Metal and Auto

E. Non-public Occupied Space Multipurpose Dry Chemical [5 lb] (2.27 kg) on Bracket

1. I.E., Boiler rooms and mechanical spaces, electrical and data rooms, receiving areas, storage rooms and elevator equipment rooms.

END OF SECTION 10 44 00

SECTION 12 21 13
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. See Section 06 10 00.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

1.04 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:

1. Manufacturer’s standard limited lifetime warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:

1. Graber Blinds; Aluminum Standard Blinds: www.graberblinds.com.
2. Hunter Douglas Architectural; CD Model: www.hunterdouglasarchitectural.com.
3. Levolor; Mark I -1" Blind: www.levolor.com/commercial.
4. SWFcontract, a division of Springs Window Fashions, LLC; S3000 1" Mini Blinds: www.swfcontract.com.

2.02 BLINDS

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Slat Support: polyester cord, ladder configuration.

C. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

1. Color: Same as slats.

D. Bottom Rail: Pre-finished, formed steel; with end caps.

1. Color: Same as headrail.

E. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.

F. Control Wand: Extruded hollow plastic; hexagonal shape.

1. Non-removable type.
2. Length of window opening height less 3 inch (76 mm).
3. Color: Clear.

G. Headrail Attachment: Type as required for installation.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/2 inch (12.7 mm).

C. At openings requiring multiple blind units, provide separate blind assemblies with space of 3/4 inch (19.05 mm) between blinds, located at window mullion centers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 06 10 00.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).

B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

END OF SECTION 12 21 13

SECTION 12 24 00
WINDOW SHADES

TURN OFF MOTORIZED SHADES
TURN OFF BLACKOUT SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.
B. Interior motorized roller shades.
C. Motor controls.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
B. Preinstallation Meeting: Convene prior to roughing in of electrical work related to products of this section; require attendance of affected installers.
C. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
C. Selection Samples: Include fabric samples in full range of available colors and patterns.
D. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.
E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
B. Handle and store shades in accordance with manufacturer's recommendations.

1.05 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Manufacturer’s standard limited lifetime warranty.
   2. Electric Motors and Controls: Five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com.
   3. Levolor; Manual Roller Shades: www.levolor.com/commercial.
   4. Lutron Electronics Co., Inc; Contract Roller Manual Roller Shades: www.lutron.com.
   5. MechoShade Systems LLC; Mecho/7 System: www.mechoshade.com.
   6. Rollease Acmeda Contract; Contract Series One Medium Open Dual Roller Shade: www.rolleaseacmedacontract.com.
   7. TimberBlindMetroShade; SolarVue Manual Roller Shade: www.timberblinds.com/commercial-division.

8. SWFcontract, a division of Springs Window Fashions, LLC.; Pro Series Manual Solar Shade System: www.swfcontract.com.

B. Interior Motorized Roller Shades, Motors and Motor Controls:
1. Draper, Inc; Motorized FlexShade: www.draperinc.com.
2. Hunter Douglas Architectural; RB500 Motorized Roller Shades: www.hunterdouglasarchitectural.com.
3. Levolor; Motorized Roller Shades: www.levolor.com/commercial.com.
4. Lutron Electronics Co., Inc; Contract Roller Motorized Roller Shades: www.lutron.com.
5. MechoShade Systems LLC; Electroshade: www.mechoshade.com.
6. Rollease Acmeda Contract; Contract Series One: www.rolleaseacmedacontract.com.
7. TimberBlindMetroShade; Motorized Roller Shades: www.timberblinds.com/commercial-division.
8. SWFcontract, a division of Springs Window Fashions, LLC; Motorized Solar Shades: www.swfcontract.com.

2.02 ROLLER SHADES

A. General:
1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
2. Provide shade system that operates smoothly when shades are raised or lowered.
3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
   a. Comply with NFPA 70.
   b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
   c. Motors:
      1) Line-voltage Tubular Motors-RTS/Digital Network-RS 485/Wired Technology:
         (a) Basis of Design: Somfy Systems: Sonesse ULTRA 50AC; www.somfysystems.com.
         (b) Equivalent products by other manufacturers are acceptable.
            (1) Voltage: 120 VAC - 60 HZ.
            (2) Speed: Minimum 24 RPM.
            (3) Torque: Minimum 4 Nm.
            (4) Audible Noise: Maximum 38 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.
      2) Low-voltage Tubular Motors-RTS/Digital Network-RS 485 :
         (a) Basis of Design: Somfy Systems: Sonesse ULTRA 50DC; www.somfysystems.com.
         (b) Equivalent products by other manufacturers are acceptable.
         (c) Voltage: 24V-DC.
         (d) Speed: Minimum 25 RPM (adjustable speed).
         (e) Torque: Minimum 4 Nm.
         (f) Audible Noise: Maximum 38 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.

B. Roller Shades:
1. Description - Interior Roller Shades: Single roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
2. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
   a. Drop Position: Regular roll.
   b. Roll Direction: Bottom-up, closed position is at top of window opening.
   c. Mounting: Ceiling mounted.
   d. Mounting: Recess mounted in ceiling pocket.
   e. Mounting: Wall mounted.
   f. Mounting: Window jamb mounted - inside, between jambs.
   g. Mounting: Window jamb mounted - outside, on face of jambs.
   h. Size: As indicated on drawings.

3. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    a. Material: Stamped steel.
    b. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
4. Roller Tubes: As required for type of shade operation.
    a. Material: Extruded aluminum, galvanized steel or enameled steel.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge or double-sided adhesive tape.
    d. Take-Up Roller: Manufacturer's standard roller tube pretensioned for winding lift cable in bottom-up type shades.
    e. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
5. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturers standard options.
6. Accessories:
    a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
        1) Profile: Square.
    b. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.
        1) Profile: Square.
    c. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
        1) Color: White.
        2) Profile: Square.
    d. End Caps for use with Fascia: Provide manufacturer's standard end caps to cover exposed ends of brackets.
    e. Blackout Shades:
        1) ShadesLight Gap Reduction Channels: Provide extruded aluminum channels to reduce light leakage at sides of shades.
        2) Provide a slot in bottom bar with wool-pile light seal.
        3) Interior Side Channels: As required for light sealing blackout shade applications.
    f. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting shade hardware into ceiling. Provide removable closure panel to conceal underside of brackets and roller tubes.
    g. Ceiling Pockets with Prewired Raceway: UL 325 listed, extruded aluminum shade pocket with removable closure panel and ceiling tile support, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
    h. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
    1. Performance Requirements:
        a. Flammability: Pass NFPA 701 large and small tests.
        b. Fungal Resistance: No growth when tested according to ASTM G21.
    2. Manufacturer/Material/Openess/UV Blockage/Fabric Color: See Interior Material Finish/Color Schedule on the Drawings..
    3. Fabrication:
        a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
        b. If height of opening requires multiple panels of railroaded fabric, use battens at seams.
        c. Battens: Full width of shade, enclose in welded shade fabric pocket.

B. Fabric for blackout shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Color: As selected by Architect from manufacturer's full range of colors.
   3. Color: See Interior Material Finish/Color Schedule on the Drawings.
   4. Fabrication:
      a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
      b. If height of opening requires multiple panels of railroaded fabric, use battens at seams.
      c. Battens: Full width of shade, enclose in welded shade fabric pocket.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
B. Provide all components and connections necessary to interface with other systems as indicated.
C. Digital Network Controls:
   1. Intelligent Motors and Devices: Identifiable over network without separate interface.
   2. Provide suitable interface modules as indicated or as required for connection to standard (nonintelligent) motors and devices.
   3. Capable of reprogrammed control without requiring wiring modifications.
   4. Capable of assigning shade motors to shade groups/sub-groups.
   5. Capable of storing programmable open and close limits and minimum of three intermediate preset stop positions for each shade.
   6. Capable of aligning adjacent shades within accuracy of plus/minus 0.25 inch (6.4 mm).
   7. Provide 10 year nonvolatile power failure memory for system configuration settings.
   8. Capable of operating from a smartphone or tablet.
D. Manual Controls:
   1. Control Functions:
      a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
      b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
      c. Raise: Raise controlled shade(s) only while button is pressed.
      d. Lower: Lower controlled shade(s) only while button is pressed.
      e. Presets: For selection of predetermined shade positions.
      f. Multiple Shade Groups: Provide individual controls for each shade group as indicated.
   2. Wall Controls: Provided by shade manufacturer.
      a. Finish: White.
      b. Finish: Ivory.
      c. Finish: Gray.
      d. Finish: Black.
      e. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.
E. Handheld Remote Controls: Battery-powered; wireless (radio frequency) or infrared; provided by shade manufacturer.
   1. Wireless (Radio Frequency) Range: 30 feet (9 m).
   2. Finish: Manufacturer's standard finish, unless otherwise indicated.
   3. Quantity: One remote for each room with motorized blinds.
F. Timeclock:
   1. Program Capability: Digital astronomic type, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days; automatically adjusts for seasonal changes in sunrise and sunset times.
   2. Provide automatic daylight savings time compensation.
   3. Provide power outage backup to retain programming and maintain clock.
G. Automatic Solar-Tracking Controls:

1. Calculates the sun's position in the sky relative to the building and then calculates when shade movement is necessary by facade/control zone.
2. Calculates the position of the shade to limit direct sunlight penetration to a predetermined limit.
3. Shades along same facade/control zone to align and start, stop, and track in unison to maintain a consistent aesthetic.
4. Algorithms to include consideration of:
    a. Building location.
    b. Facade orientation.
    c. Window dimensions.
    d. Allowable solar depth of penetration.
5. Override Capability:
    a. Capable of automatic override of shade positions for:
        1) Dark conditions (e.g., cloudy), based on input from photosensor(s); shades to go to predetermined position to maximize occupant view and available daylight.
        2) User-defined programmable schedule.
    b. Capable of manual temporary override of shade positions using:
        1) Wall controls.

2.05 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.

1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
2. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify General Contractor or Construction Manager of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

B. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 12 24 00

SECTION 12 32 00
CASEWORK

TURN OFF SOLID SURFACE COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured standard and custom casework, with cabinet hardware and accessories.
   1. Plastic Laminate.
B. Countertops:
   1. Solid Surface.
      a. Under mount sinks.
C. Wall mounted adjustable p-lam shelving.
D. Window stools/sills:
   1. Solid Surface.
E. Aluminum trim on Casework.
F. Miscellaneous accessories.

1.02 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor (unless visible from an upper floor) and all members visible in open cases or behind glass doors.
B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.
C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Component dimensions, configurations, construction details, joint details, attachments, stock items.
C. Shop Drawings for Casework: Indicate casework types, sizes, and locations, using large scale plans, elevations, doors and door swings, sections of typical/special cabinets and cross sections. Indicate core materials, edge treatments and construction. Include rough-in and anchors, reinforcements, and blocking, placement dimensions and tolerances, clearances required, and keying information.
   1. For file suspension system mounted on tops of drawer sides, confirm width of hanging files.
D. Shop Drawings for Work Surfaces: Plans and locations of each work surface, indicating dimensions. Indicate locations and sizes of all openings including those for sinks. Indicate provisions for securing work surfaces to cases, windowsills.
E. Samples for Finish Selection: Minimum sample size: 2 inches by 3 inches (51 mm by 75 mm).
   1. Plastic laminate samples, for color, texture, and finish selection.
   2. Solid Surface samples, for color, texture and finish selection.
   3. PVC Edging for color and size.
   4. Quartz samples for color, texture and finish selection.
F. Provide samples of hinges and pulls for color selection.
G. Manufacturer's QCP Qualification Documentation.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
B. Manufacturer must be a member of AWI.
C. Quality Certification: Comply with AWI (QCP) woodwork association quality certification service/program in accordance with P10.3-GCP License 10.3 Casework HPDL.
   1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.

3. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
4. Replace, repair, or rework all work for which certification is refused.

D. Installer Qualifications: Company specializing in performing work of the type specified in this section with trained installers, with not less than five years of documented experience and approved by manufacturer.

E. Single Source Manufacturer: Casework, countertops and architectural millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework, countertops and/or architectural millwork between multiple manufacturers will not be permitted.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:
1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:
1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

D. Transport, store and handle countertops in accordance with manufacturers recommendations.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Casework within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
1. Ruptured, cracked, or stained finish coating.
2. Discoloration or lack of finish integrity.
3. Cracking or peeling of finish.
4. Delamination of components.
5. Failure of adhesives.
6. Failure of hardware.

C. Solid Surface: Manufacturers standard 10 year warranty on materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Any fabricator/millwork shop meeting the specifications with minor construction deviations are acceptable.

B. Casework:
1. Plastic Laminate.

2.02 CASEWORK, GENERAL

A. Quality Standard: AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom Grade.

C. Approved material manufacturers:
1. A manufacturer listed in both the specification and the Interior Material Finish/Color Schedule, on the Drawings is not required to submit a pre-bid approval.
2. Manufacturers listed in this specification, but not in the Interior Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval. Approval will be listed by addendum.
3. When no colors are listed in the Interior Material Finish/Color Schedule, on Architectural Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

2.03 PLASTIC-LAMINATE CASEWORK

A. Plastic-Laminate Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.

1. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths, depths and heights indicated on drawings.
2. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
    a. Finish and Color: See Interior Material Finish/Color Schedule on Drawings.
    b. Exposed Interior Surfaces: Match exterior of cabinets.
        1) Color: as selected from manufacturer's standard colors.

2.04 COUNTERTOPS

A. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade, unless otherwise noted.

B. Support brackets for wall mounted countertops:
1. A & M Hardware: Hybrid 1.5" T-shaped Workstation Brackets; www.aandmhardware.com.
    a. Equivalent products by other manufacturers are acceptable.
2. Powder coated, 1/8 inch (3.175 mm) steel with integral cleat mount, for use as surface or concealed mounting as detailed. Predrilled with 1/4 inch (6.35 mm) mounting holes.
    a. Sizes as required based on countertop depth.
    b. Minimum load per bracket: 500 pounds (226.796 kg).

C. Solid Surfacing Countertops: Solid surfacing sheet over continuous substrate of plywood.
1. Configuration for exposed edges, back and end splashes, with details indicated on drawings.
2. Fabricate in accordance with manufacturer's standard requirements.
3. Install solid surface countertops over 3/4 inch (19.05 mm) plywood.
4. All countertop joints must be dry fit at the factory to check for consistency in color from one panel to the other and overall finished panel thickness, resulting in a high quality product easy to install.
5. Manufacturers/Series/Colors/Patterns: See Interior Material Finish/Color Schedule on the Drawings.

2.05 WINDOW STOOLS/SILLS

A. Solid Surfacing: Solid surfacing sheet over continuous substrate of plywood.
1. 1-1/8 inch (28.575 mm) thick unless noted different on the drawings.
2. For stools/sills over 7 feet (2.1336 m) in length, provide expansion joint with color match polyurethane or silicone sealant and backer rod at maximum of 8 foot (2.438 m) o.c.
    a. Submit shop drawings that identify each stool/sill and locate expansion joint for review by Architect.
3. Edge treatment: As detailed.
4. Back and side splash: Applied.
5. Colors:
    a. See Interior Material Finish/Color Schedule on the Drawings.

2.06 CABINET HARDWARE

A. Comply with BHMA A156.9 requirements.
1. Acceptable base materials for plated finishes include brass, bronze, and steel.

B. Adjustable Shelves in Cabinets:
1. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32 mm centers.
2. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support.
3. The support automatically adapts to ¾ inch or 1 inch thick shelving and provides non-tip feature for shelving.
4. Supports may be filed fixed if desired. Structural load to 1200 pounds (544.3108 kg) [300 pounds (136.078 kg) per support] without failure.

C. Swinging Doors: Hinges, pulls, and catches.
1. Hinges: Visible, number as required by referenced standards for width, height, and weight of door.
    a. Five knuckle, epoxy powder coated, institutional grade, 2-3/4 inch (69.85 mm) overlay type with hospital tip. 0.095 inch (2.413 mm) thick. ANSI-BHMA standard A156.9, Grade 1.
    b. Doors 48 inches (1219.2 mm) and over in height have 3 hinges per door.

c. Magnetic door catch with maximum 5 pound (2.268 kg) pull provided, attached with screws and slotted for adjustment.
d. Colors:
e. See Interior Material Finish/Color Schedule on the Drawings.

2. Hinges: Concealed of heavy gauge metal construction, 200,000 open/close cycle test, with hinge manufacturer's lifetime material replacement guarantee.
a. 170 degree swing. Fully adjustable for clockwise, counter-clockwise, toe-in and out door alignment.
b. Provide base plates to maintain 1/8 inch (3.175 mm) reveals between doors/drawers within the same cabinet, and between doors of adjoining cabinets. Doors shall be self closing and fitted with silencer bumpers.

3. Doors shall be fitted with silencer bumpers.
a. Hinges: Installed on framed cabinet face, and on door face.

4. Pulls: Brushed stainless steel wire pulls, 4 inches (102 mm) wide.

5. Decorative Pulls:
a. EPCO Products: AP128-SS Stainless Arch Pull; www.epcohardware.com.
1) 5 inch (128 mm) center to center; 13/32 inch (10 mm) bar diameter; 1-1/4 inch (32 mm) projection.

6. Catches: Magnetic.

2.07 MATERIALS

A. Adhesives Used for Assembly: Comply with VOC requirements for adhesives and sealants; see Section 01 61 16.

B. Wood-Based Materials:
1. Plywood for Sub-base: Preservative treated exterior grade plywood, ¾ inch (19.05 mm) thick.
2. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.

C. Plastic Laminate: High Pressure Decorative Laminate (HPDL): NEMA LD 3, as follows:
1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.
2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.
3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.
5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.

D. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering and complying with ANSI Z97.1; 1/4 inch (6 mm) thick minimum; exposed edges ground, and cut or drilled to receive hardware; clear.
1. Decorative glass:

2.08 ACCESSORIES

A. Plastic Edge Banding: Extruded PVC,flat or convex shaped; smooth finish; self-locking serrated tongue; of width to match component thickness.
1. Plastic-Laminate Countertops, backsplashes, open shelving, cabinet doors and drawers:
a. 3MM PVC.
b. Color: See Interior Material Finish/Color Schedule, on Drawings.

2. Cabinet body and shelf/shelving edges:
a. 1 MM.
b. Color matched to drawer/door/shelf face.

B. Coat Hooks: Ives, an Allegion Brand; www.us.allegion.com or equal.
1. Wall mounted:
a. Single coat hooks: Ives 581 satin aluminum.
b. Double coat hooks: Ives 405 satin aluminum.

2. Ceiling or bottom of shelf mounted:
a. Double coat hooks: Ives 580 satin aluminum.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Grommets: 2 inch (50.8 mm) standard plastic grommets for cut-outs, in color to blend with adjacent surface.
E. Sealant for Use in Casework Installation:
    1. One component, clear silicone base sealant, chemical curing complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, when tested to glass and aluminum, anti-fungus composition.

2.09 CASEWORK FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
B. Construction: As required for selected grade.
C. Structural Performance: Safely support the following minimum loads:
    1. Base Units: 500 pounds per linear foot (744 kgs/linear m) across the cabinet ends.
    2. Suspended Units: 300 pounds (136 kg) static load.
    3. Drawers: 125 pounds (57 kg), minimum.
    4. Hanging Wall Cases: 300 pounds (135 kg).
    5. Shelves: 100 pounds (45 kg), minimum.
D. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.
E. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and square to within 0.010 inches (0.254 mm), ensuring strict dimensional quality and structural integrity in the final fabricated product.
F. Provide cutouts for power receptacles where indicated on electrical drawings.
G. Cabinet Body Construction:
    1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails, and verticals.
        a. Tops, bottoms, and sides of all cabinets are particleboard core.
    2. Cabinet backs: ¼ inch (19.05 mm) thick medium density fiberboard panel fully captured by the cabinet top, bottom, and side panels. Finish to match cabinet interior.
        a. 3/4 x 4 inch (19.05 x 101.6 mm) particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches (17.0688 mm) . Utilize hot melt glue to further secure back and increase overall strength.
        b. Exposed back on fixed or movable cabinets: ¾ inch (19.05 mm) thick particleboard with the exterior surface finished in VGS laminate as selected.
        c. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.
    3. Fixed base and tall units have an individual factory-applied base, constructed of ¾ inch (19.05 mm) thick plywood.
        a. Base is 102mm (nominal 4 inch) high unless otherwise indicated on the drawings.
    4. Base units, except sink base units: Full sub-top glued and doweled to cabinet sides.
        a. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.
    5. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides, and pull-out shelves in the line boring for consistent alignment.
    6. Exposed and semi exposed edges.
        a. Edging: 3MM PVC on open, 1MM PVC on closed shelving, machine applied.
    7. Adjustable Shelves in Cabinets
        a. Core: Particleboard, ¾ inch (19.05 mm) thick up to 30 inches (762 mm) wide, 1 inch (25.4 mm) thick over 30 inches (762 mm) wide.
        b. Edge: 1mm PVC on Front Edge Only.
    8. Interior finish, units with open interiors:
        a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with high-pressure decorative VFS laminate.
    9. Interior finish, units with closed interiors:
        a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with TFM Thermally Fused Melamine laminate.

10. Exposed ends:
    a. Faced with high-pressure decorative VFS laminate.
11. Wall unit bottom:
    a. Faced with thermally fused melamine laminate.
12. Balanced construction of all laminated panels is mandatory.
13. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

H. Drawers:
1. Sides, back and sub front: Minimum ½ inch (12.7 mm) thick particleboard laminated with TFM Thermally Fused Melamine doweled and glued into sides. Top edge banded with 1mm PVC.
2. Drawer bottom: Minimum ½ inch (12.7 mm) thick particleboard laminated with TFM Thermally Fused Melamine, screwed directly to the bottom edges of drawer box.
3. Paper storage drawers: Minimum ¾ inch (19.05 mm) thick particleboard sides, back, and sub front laminated with TFM Thermally Fused Melamine. Minimum ½ inch (12.7 mm) thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

I. Door/Drawer Fronts:
1. Core: ¾ inch (19.05 mm) thick particleboard.
2. High-pressure decorative VGS laminate exterior, balanced with high-pressure cabinet liner CLS.
3. Edges: 3mm PVC, machine applied, external edges and outside corners machine profiled to 1/8 inch (3.715 mm) radius.
4. Provide double doors in opening in excess of 24 inches (609.6 mm) wide.
5. Paper storage drawers to be fitted with full width hood at back.
6. Light resistant drawer for dark rooms: cover over drawer with flush mount finger pull, full width piano hinge and light resistant perimeter gasket.

J. Miscellaneous Shelving (not in Cabinets):
1. Core material: 1 inch (25.4 mm) thick particleboard.
2. High-pressure decorative VGS laminate on both faces.
3. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch (3.715 mm) radius.

K. Vertical and Horizontal Dividers:
1. Vertical: Tempered hardboard 1/4 inch thick (6.35 mm), smooth both faces. Secured in cabinet with molded plastic clips.
2. Horizontal: Melamine laminated core 3/4 inch (19.05 mm)thickness. Secured in cabinet with molded plastic clips or dowels.

PART 3 EXECUTION

3.01 PREPARATION

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 EXAMINATION

A. Site Verification of Environmental Conditions:
1. Do not deliver casework until the following conditions have been met:
    a. Building has been enclosed (windows and doors sealed and weather-tight).
    b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
    c. Ceiling, overhead ductwork, piping, and lighting have been installed.
    d. Installation areas do not require further “wet work” construction.

B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch (13 mm) leveling adjustment. Contact the Construction Manager or General Contractor for correction. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.

C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:

1. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more, and/or maximum variation from plumb exceeds 1/4 inch (6 mm)per story.
2. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.
3. Contact the Construction Manager or General Contractor for correction.

D. Verify adequacy of support framing and anchors.

E. Verify that service connections are correctly located and of proper characteristics.

3.03 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

C. Set casework items plumb and square, securely anchored to building structure.

D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
2. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).

F. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches (610 mm) on center, and at sides of cabinets with not less than two fasteners per side.

G. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches (407 mm) on center.

H. Install hardware uniformly and precisely.

I. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.

J. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.05 CLEANING

A. Clean casework and other installed surfaces thoroughly, including inside of cabinets and drawers.

3.06 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.

C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION 12 32 00

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Transition fittings.
2. Dielectric fittings.
3. Pipe sleeves.
4. Sleeves seals.
5. Escutcheons.
6. Grout.
7. Plumbing demolition.
8. Equipment and system installation common requirements.
9. Painting.
10. Concrete bases.
11. Supports and anchorages.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.03 SUBMITTALS

A. Welding certificates.

1.04 QUALITY ASSURANCE

A. Product and Material Origin: All materials and products shall be manufactured within the 12 months of delivery to the site. Provide factory certified verification of the date of manufacture upon request form the Engineer.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. Lead Free Requirements: All plumbing pipes, fittings, valves, fixtures, and other components in systems providing water for human consumption shall be 'lead-free' in accordance with the "Reduction of Lead in Drinking Water Act" and the "Safe Drinking Water Act", where the term 'lead-free' is defined to mean – "not containing more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."

1. Lead-free products shall be compliant with the requirements of either NSF 61-G or NSF 372.

2. Lead-free products shall bear a certified mark by a nationally accredited certification body.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. Storage of materials and equipment shall not impede the work of other contracts.

D. Handling of equipment and products shall be according to manufacturers instructions and in compliance with the articles of their warranty.

E. Protect products from weather, unless product is slated for exterior installation. If outdoor storage is necessary, support products off the ground or pavement in watertight enclosures.

1.06 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for system installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for systems requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.07 PRODUCT SUBSTITUTIONS

A. Equipment manufacturer's where indicated on the drawings are the basis for design. The contractor accepts responsibility for all design implications when providing approved equipment other than the design basis.

B. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics than the basis of design may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. Required electrical modifications must be approved by the Electrical Engineer and be provided at no additional cost to the Owner. Required electrical modifications must be approved by the Electrical Engineer and be provided at no additional cost to the Owner. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

C. Dimensional and Weight Changes: Equipment with dimensions or weight different than the basis of design may be furnished provided such proposed equipment is approved in writing. The contractor is responsible for verifying proposed equipment maintains the design intent for access and serviceability and reserves space for future equipment where required. Cost implications to other trades are the responsibility of the contractor.

1.08 INTERPRETATION OF PLANS

A. In general, the Drawings are to scale. However, to determine exact locations of walls and partitions, the Contractor shall consult the architectural and/or structural Drawings which are dimensioned. Drawings shall not take precedence over field measurements.

B. Drawings are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail of construction. All work shall be constructed from field measurements taken at the site. This shall include all rises, drops and offsets necessary to avoid structural members or equipment and materials installed by other trades. The contractor shall coordinate the ductwork and piping layout before construction. No additional costs will be allowed for piping and ductwork fabrications without field verification of available space. If it is found, before installation, that a more convenient, suitable or workable arrangement of any or all phases of construction would result by altering the arrangement indicated on the Drawings, the architect/engineer may require the contractor to change the arrangement of his work without additional cost to the owner.

C. The drawings and specifications are intended to supplement each other. Any items shown on the drawings and not mentioned in the specifications, or vice versa, shall be executed the same as if mentioned and shown.

D. The greatest quantity or more expensive work shall govern where there is a conflict noted anywhere on the drawings and/or specifications.

1.09 COORDINATION DRAWINGS

A. Review contract documents and prepare coordination drawings as an informational submittal in accordance with Division 1 requirements. Provide drawings of all areas of the project to the Division 23 contractor. Participate in coordination meetings and revise drawings at the direction of the Division 23 contractor to resolve work conflicts. Conflicts between trades or existing conditions that arise due to work not being coordinated prior to installation shall be resolved at no cost to the Owner.

B. The Division 23 contractor will coordinate the preparation of drawings by other trades including steel, precast concrete, fire protection, lighting, plumbing, piping, and building sound systems. The Division 23 contractor will create composite drawings showing the work of all other trades. The Division 23 contractor will facilitate coordination meetings as scheduled and coordinated by the General Contractor or Construction Manger to review potential conflicts and propose specific solutions. Any proposed revisions to the Contract Documents shall be noted on the coordination drawings for review by the Architect and Engineer.

C. The composite drawings of all trades shall detail all structural building elements, mechanical equipment, and work of other trades. Indicate locations where space is limited for installation, access for service, and where sequencing and coordination of installations are of importance to the efficient flow of work. The composite drawings shall include at a minimum the following. Where required for clarity multiple composite drawings may have to be submitted for each area.

1. Clearances for installing and maintaining insulation.

2. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

3. Equipment connections and support details.

4. Exterior wall and foundation penetrations.

5. Fire-rated wall and floor penetrations.

6. Sizes and locations of required concrete pads and bases.

7. Valve stem movement.

8. Dimensional locations of pipe sleeves passing through floor/roof slabs.

9. Locations of wall and ceiling access panels where required for access to mechanical equipment.

10. Reflected ceiling plans to integrate installations of light fixtures, grilles, registers, and diffusers, sprinklers, communication systems, and other ceiling mounted components.

11. Both new and existing structural elements.

1.10 COST BREAKDOWN

A. Submit a cost breakdown for each claim according to General Conditions of the Contract. Include project name, location, Architect/Engineer, Contractor and date.

1. List the cost breakdown for labor and material separately and include a total.

2. Breakout and detail the cost according to specification sections.

1.11 UTILITY REBATES

A. Prepare and submit utility rebate application forms and supporting documentation that are applicable within the scope of this project. Coordinate submittal with the project engineer and Owner’s representative.

1.12 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "Project Record Documents." In addition to the requirements specified in Division 1, refer to specific sections for additional record documentation.

1.13 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "Operating, Maintenance, and Warranty Data". Submit copies for review by Architect/Engineer. In addition to the requirements specified in Division 1, include the following information:

1. Descriptive summary of function, normal system operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

5. Warranty information for all mechanical items shall be included in one tabbed section.

1.14 FIRE SAFETY PRECAUTIONS

A. The Contractors shall exercise extreme care to maintain and exercise adequate fire safety precautions throughout the work. This shall include providing sufficient fire fighting devices, watchmen, standby helpers or other precautions during construction, in use of temporary heat, welding, brazing, sweating, testing or other phases of work.

B. At all times, access shall be maintained for fire department trucks to the building.

C. All welding brazing, cutting and sweating operations performed in vicinity of or accessible to combustible materials shall be adequately protected to make certain that sparks or hot slag does not reach the combustible material and start a fire.

D. All glass, glazed materials and other finish, in the vicinity of welding, brazing and cutting, shall be masked by the Contractor performing the welding work.

E. When necessary to do cutting, welding, brazing, sweating and similar work in vicinity of wood, in shafts, or vicinity of any combustible material (and the combustible material cannot be removed), the materials shall be adequately protected with fire resistant blankets or similar approved coverings. In addition, a helper shall be stationed nearby with proper fire extinguishers (provided by the Contractor performing the work) to guard against sparks and fire.

F. Whenever combustible materials have been exposed to sparks, molten metal, hot slag or splatter, a person shall be kept at the place of work to make sure the smoldering fires have not been started. Whenever cutting or welding operations are carried on in a vertical pipe shaft, a person to act as a fireguard shall be employed to examine all floors below the point of cutting or welding. This fireguard shall be kept on duty after completion of work to guard against fires and shall examine each level after this time, prior to leaving. There shall be no exceptions to this requirement and failure to comply will be construed as negligence.

1.15 PERSONAL SAFETY REQUIREMENTS

A. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions required in connection with his work, including regulations of the Occupational Safety and Health Administration (OSHA) and other governing agencies.

1.16 PERMITS, LICENSES AND FEES

A. The Contractor shall secure all permits and licenses, both temporary and permanent required for their work. The Contractor shall pay all fees and expenses required for the permits and licenses.

1. The Contractor shall make all arrangements with each utility company and pay all service charges associated with new services or modifications to existing services.

2. The Contractor shall request inspections as required by regulating agencies and/or regulations. The Contractor shall pay all charges for inspections.

3. Contractor shall furnish the Owner with a certificate of final inspection and approval by enforcement authorities.

4. Comply with requirements of Division 00.

1.17 CORRECTIVE PERIOD / GUARANTEE

A. The Contractor shall guarantee and maintain the stability of work and materials and keep same in perfect repair and condition for the period of one (1) year after the Date of Substantial Completion of the Project.

B. Defects of any kind due to faulty work or materials appearing during the above mentioned period must be immediately made good by the Contractor at his own expense to the entire satisfaction of the Owner and Architect and Engineer Such reconstruction and repairs shall include damage to the finish or the building resulting from the original defect or repairs thereto.

C. The guarantee shall not apply to injuries occurring after final acceptance and due to wind, fire, violence, abuse or carelessness or other Contractors or their employees of the agents of the Owner.

D. This guarantee shall not apply where other guarantees for different lengths of time are specifically called for.

PART 2: PRODUCTS

2.01 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Plastic-to-Metal Transition Fittings: One-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D. Plastic-to-Metal Transition Unions: MSS SP-107, four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.02 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.03 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

2.05 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening. Provide brass material with polished chrome plated finish.

2.06 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, drain, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Lead Containing Materials: The existing building may contain lead-containing materials, including lead paint. It is the Contractor's responsibility to meet all governmental regulations when dealing with the disposing of lead containing materials.

E. Remove from building site debris, rubbish, fluids, and other materials resulting from demolition operations. Transport and legally dispose of offsite.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on project site.

3.02 EQUIPMENT AND SYSTEM INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install transition fittings where necessary to accommodate installed materials of construction.

F. Install dielectric fittings at all metallic joints of dissimilar metal.

G. Install chrome plated brass escutcheons for penetrations of walls ceilings, and floors that are not concealed above a ceiling.

3.03 PIPE SLEEVE INSTALLATION

A. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. For pipes penetrating gypsum-board partitions: Schedule 40 steel pipe sleeves or steel sheet sleeves.

   b. For all penetrations other than gypsum board partitions: Cast iron or schedule 40 steel sleeves.

   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Flashing" for flashing.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Sealants and Caulking" for materials and installation.

B. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install Schedule 40 galvanized steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

C. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Firestopping" for materials.

3.04 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.05 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section.

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.08 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 22 05 00

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.

1.02 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

1.04 QUALITY ASSURANCE

A. Lead Free Requirements: All plumbing pipes, fittings, valves, fixtures, and other components in systems providing water for human consumption shall be 'lead-free' in accordance with the "Reduction of Lead in Drinking Water Act" and the "Safe Drinking Water Act", where the term 'lead-free' is defined to mean – "not containing more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."

1. Lead-free products shall be compliant with the requirements of either NSF 61-G or NSF 372.

2. Lead-free products shall bear a certified mark by a nationally accredited certification body.

PART 2: PRODUCTS

2.01 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Palmer - Wahl Instruments Inc.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: Die-cast aluminum or brass, 7 inches long.

C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.02 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. KOBOLD Instruments, Inc.
3. Marsh Bellofram.
4. Trerice, H. O. Co.
5. Weiss Instruments, Inc.
6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: Liquid-filled type, drawn steel or cast aluminum 5" diameter.

C. Element: Bourdon tube or other type of pressure element.

D. Movement: Mechanical, connecting element and pointer.

E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

F. Pointer: Red metal.

G. Window: Glass.

H. Ring: Brass is unfinished areas including mechanical rooms; stainless steel in finished areas.

I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

J. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.03 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.04 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Marsh Bellofram.
3. Palmer - Wahl Instruments Inc.
4. Trerice, H. O. Co.

5. Weiss Instruments, Inc.
6. Winters Instruments.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type drawn steel or cast aluminum 2" diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass.
8. Ring: Brass in unfinished areas including mechanical rooms; stainless steel in finished areas.
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.05 TEST PLUGS

A. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

B. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

C. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.

2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.

PART 3: EXECUTION

3.01 THERMOMETER APPLICATIONS

A. Install thermometers in the outlet of each domestic, hot-water storage tank where indicated.

B. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 240 deg F with 2-degree scale divisions.

2. Domestic Cold Water: 0 to 100 deg F with 2-degree scale divisions.

3.02 GAGE APPLICATIONS

A. Install pressure gage at water service entrance at inlet and discharge of each pressure reducing valve, and as indicated.

B. Pressure gage ranges shall be twice the normal operating pressure.

3.03 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.
B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install needle-valve and snubber fitting in piping for each pressure gage.

E. Install test plugs in tees in piping.

F. Install permanent indicators on walls or brackets in accessible and readable positions.

G. Install connection fittings for attachment to portable indicators in accessible locations.

H. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

I. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 22 05 19

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze lift check valves.
3. Bronze swing check valves.
4. Bronze gate valves.
5. Bronze globe valves.

1.02 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.03 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.04 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

2. ASME B31.1 for power piping valves.

3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. Lead Free Requirements: All plumbing pipes, fittings, valves, fixtures, and other components in systems providing water for human consumption shall be 'lead-free' in accordance with the "Reduction of Lead in Drinking Water Act" and the "Safe Drinking Water Act", where the term 'lead-free' is defined to mean – "not containing more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."

1. Lead-free products shall be compliant with the requirements of either NSF 61-G or NSF 372.

2. Lead-free products shall bear a certified mark by a nationally accredited certification body.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.

3. Set angle, gate, and globe valves closed to prevent rattling.

4. Set ball and plug valves open to minimize exposure of functional surfaces.

5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.

2. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Grooved: With grooves according to AWWA C606.

3. Solder Joint: With sockets according to ASME B16.18.

4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.03 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: NBR, PTFE, or TFE.

2.04 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.
    b. Milwaukee Valve Company.
    c. NIBCO INC.

2. Description:

    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 300 psig.
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

2.05 BRONZE GATE VALVES

A. Class 150, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Kitz Corporation.
    b. Milwaukee Valve Company.
    c. Powell Valves.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 300 psig.
    c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron.

2.06 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Powell Valves.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 300 psig.
    c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: PTFE or TFE.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

    1. Swing Check Valves: In horizontal position with hinge pin level.

    2. Lift Check Valves: With stem upright and plumb.

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.

2. Throttling Service: Globe or ball valves.

3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or solder ends.

3.05 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint or threaded ends.

2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.

3. Bronze Swing Check Valves: Class 150, bronze disc.

4. Bronze Globe Valves: Class 150, nonmetallic disc.

END OF SECTION 22 05 23

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe positioning systems.
7. Equipment supports.

1.02 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

PART 2: PRODUCTS

2.01 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.04 INSULATION INSERT

A. Description: 100-psig minimum, compressive-strength insulation insert.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insulation insert shall cover the entire point of contact with the pipe hanger or bracket.

E. For Clevis or Band Hangers: Insulation insert shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 INSULATION SHIELD

A. Description: 16 gauge galvanized sheet metal formed to fit contour of pipe insulation.

B. Shield Length: Minimum 12”.

2.06 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.07 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

2.08 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.09 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3: EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.

3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.

6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.

11. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

13. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.

14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

15. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Insulation Insert Installation: Install in pipe hanger for all insulated piping 2” and larger.

E. Insulation Shield: Install insulation shields at all hanger locations for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above or below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

   b. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold and hot piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers. Provide with continuous vapor barrier.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to a maximum of 1-1/2 inches. Threaded rods shall be trimmed to be flush with supports in exposed areas at 7'-0" and lower.

3.06 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

1.02 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.03 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel, rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.03 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link, beaded chain, or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Provide equipment labels for each piece of equipment identified on the drawing schedule.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section “Painting.”

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Sanitary Waste Piping:

   a. Background Color: Green.
   b. Letter Color: White.

3.04 VALVE-TAG INSTALLATION

A. Install tags on main and branch line shut off valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves at equipment; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Cold Water: 1-1/2 inches, round.
    b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Color:

    a. Cold Water: Natural.
    b. Hot Water: Natural.

3. Letter Color:

    a. Cold Water: Black.
    b. Hot Water: Black.

END OF SECTION 22 05 53

SECTION 22 07 00

PLUMBING INSULATION

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Insulation Materials:

    a. Flexible elastomeric
    b. Mineral fiber

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.
7. Detail field application for each equipment type.

C. Qualification Data: For qualified Installer.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in applying insulation materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance. Installer shall meet, at a minimum, all requirements listed below. Upon request, submit evidence of such qualifications to the Engineer.

1. Company specializing in performing work of this section with minimum three years documented experience, minimum three successfully completed projects of similar scope and complexity, and approved by manufacturer.

2. Designate one individual as project foreman who shall be on site at all times during installation.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency. Insulation shall have a flame-spread index of 25 or less and smoke-developed index of 50 or less.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.05 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.06 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2: PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric (FE): Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials; thermal conductivity (avg) of 0.27 Btu/hr-ft^2-°F or lower at mean temperature of 75°F; 3.0 lbs./ft^3 density (ASTM D/622); 0.08 perm-in permeability (ASTM E96); 0.2% water absorption (ASTM C209).

G. Mineral-Fiber, Preformed Pipe Insulation (MF): Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL; thermal conductivity (avg) of 0.25 Btu/hr-ft^2-°F or lower at mean temperature of 75°F. Factory-applied jacket requirements are specified in “Factory-Applied Jackets” Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.

2. Service Temperature Range: Minus 50 to plus 180 deg F.

3. Color: White.

2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I, for applications where systems operate below ambient temperature at least part of the time or where a vapor barrier is required.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I, for applications where systems operate below ambient temperature at least part of the time or where a vapor barrier is required.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II, for applications where systems operate above ambient temperatures or where a vapor retarder is not required.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, as follows:

1. Shall comply with ASTM C921, Type I, for applications where systems operate below ambient temperature at least part of the time or where a vapor barrier is required.

2. Shall comply with ASTM C921, Type II, for applications where systems operate above ambient temperatures or where a vapor retarder is not required.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.

2. Color: White.

3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

C. Fitting Covers:

1. PVC Jacket: One or two piece pre-molded high impact PVC fitting covers with fiberglass inserts and accessories. Covers shall be UV resistant and comply with ASTM 1784-92. Covers shall be sized to comply with insulation applications detailed in Part 3.0.

   a. Below ambient systems: provide continuous vapor barrier in accordance with manufacturer recommendations.

   b. Fiberglass Inserts: Thermal conductivity (ASTM C177), thermal conductivity average of 0.26 Btu/hr-ft^2-˚F or lower at a mean temperature of 75 ˚F.

2.09 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 0.015 inch thick, 1/2 inch wide with wing seal.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.

c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.

c. Adhesive-backed base with a peel-off protective cover.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 PIPING INSULATION APPLICATION

A. Indoor Piping System Insulation: Insulate with insulation types and thickness as listed in Table below. If more than one pipe material is listed for a piping system, selection from materials listed is the contractor's option.

1. Potable cold water, hot water, and hot water circulating piping.
2. Plumbing vents within 6 lineal feet of roof outlet.
3. Condensate drain piping from cooling coils.

TABLE NO. 22 07 00-1: MINIMUM PIPE INSULATION

Piping System [2]	Fluid Temp Range °F	Type of Insulation [1]	¾" and Smaller	1" to 1 ¼"	1 ½" to 3"	4" and Larger
CW Piping	40-60	MF, FE	½"	½"	1"	1"
HW Piping	105-140	MF	1"	1"	1 ½"	1 ½"
CHW Piping	105-140	MF	1"	1"	1 ½"	1 ½"
Plumbing Vents	Any	MF, FE	-	-	1"	1"

NOTES:
1. Insulation material abbreviations:
   a. Mineral Fiber (MF) – with factory jacket per 2.0 requirements.
   b. Flexible Elastomeric (FE)
2. Piping Service abbreviations:
   a. Cold Water (CW)
   b. Hot Water (HW)
   c. Circulating Hot Water (CHW)
3. Insulation thickness for piping smaller than 1½" may be reduced to 1" for piping located in partitions within conditioned spaces.

B. Refer to Division 22 Section 22 05 29 "Hangers and Supports for Piping and Equipment" for insulation insert and insulation shield requirements.

C. Insulation Omitted: Omit insulation for the following:

1. Interior air conditioner condensate drain piping in mechanical rooms provided piping is less than 3 lineal feet and is located within 12" of floor.

2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3. Discharge piping from trap primer valves connected to building sanitary waste floor drain traps.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. For all insulation, seal exposed fiberglass including cut pre-formed pipe sections with manufacturer’s approved mastic.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.05 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Firestopping."

3.06 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Fiberglass inserts with PVC fitting covers are acceptable. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Provide 16 gauge galvanized sheet metal insulation shields at all hanger locations. Shields shall be a minimum 12” in length and formed to fit pipe contour.

3.07 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.08 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.09 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.

2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

END OF SECTION 22 07 00

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Domestic water pipes, tubes, fittings, and specialties.
2. Encasement for piping.
3. Specialty valves.
4. Flexible connectors.
5. Escutcheons.
6. Wall penetration systems.

1.02 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Dielectric fittings.
3. Flexible connectors.

B. Coordination Drawings: Refer to coordination drawing requirements of 22 05 00.

C. Field quality-control and test and inspection reports.

1.03 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

C. Lead Free Requirements: All plumbing pipes, fittings, valves, fixtures, and other components in systems providing water for human consumption shall be 'lead-free' in accordance with the "Reduction of Lead in Drinking Water Act" and the "Safe Drinking Water Act", where the term 'lead-free' is defined to mean – "not containing more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."

1. Lead-free products shall be compliant with the requirements of either NSF 61-G or NSF 372.

2. Lead-free products shall bear a certified mark by a nationally accredited certification body.

1.04 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.

PART 2: PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Applications" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.

2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.03 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.04 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.05 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

D. Plastic-to-Metal Transition Fittings: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions: CPVC four-part union. Include brass threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.06 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions: 150 psig at 180 degrees F., solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges: Factory-fabricated, bolted, companion-flange assembly. Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits: 150 psig rated, non-conducting materials for field assembly.

1. Gasket: Neoprene or phenolic.
2. Bolt Sleeves: Phenolic or polyethylene.
3. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings: 300 psig at 225 degrees F., galvanized steel coupling.

1. End Connections: Female threaded.
2. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples: ASTM F1545, 300 psig at 225 degrees F., electroplated steel nipple.

1. End Connections: Male threaded.
2. Lining: Inert and noncorrosive, propylene.

2.07 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

2.08 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

E. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

F. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.09 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 PIPING APPLICATIONS

A. Above Ground:

1. Pipes Tagged 4” or Smaller: Type L, drawn copper tube with wrought coper fittings and solder joints.

B. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

C. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

3.02 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.03 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.

2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.

3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.

4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

3.04 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

F. Install domestic water piping level and plumb.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

Q. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

S. Install sleeves and mechanical sleeve seals per the requirements of Division 22 Section “Common Work Results for Plumbing”.

3.05 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use ball or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.06 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.07 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.08 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

3.09 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel clevis hangers.

3. Multiple, Straight, Horizontal Piping Runs: Field fabricated, heavy duty trapeze. Fabricate from steel shapes required for loads.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install supports for vertical copper tubing every 10 feet.

E. Install supports for vertical steel piping every 15 feet.

F. Install hangers for horizontal piping with the following minimum rod sizes and maximum spacing for trapeze type hangers with multiple rise runs of varying sizes. The hangers shall be spaced based upon the smallest diameter pipe.

Nom. Pipe Size – Inches	Steel Pipe Max. Span – Ft.	Copper Tube Max. Span – Ft.	Min. Rod Dia. - Inches
Up to ¾	7	5	3/8
1	7	6	3/8
1-1/4	7	6	3/8
1-1/2	9	6	3/8
2	10	8	3/8
2-1/2	11	9	½
3	12	10	½
3-1/2	12	10	½
4	12	10	½
5	12	10	5/8
6	12	10	¾
8	12	10	7/8

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.

2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 Plumbing Fixture Sections for connection sizes.

4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.11 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors. Escutcheons in areas exposed to view shall have a chrome plated finish.

3.12 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests: The following minimum tests shall be performed. Review procedures with the local jurisdiction and provide any additional tests or procedures required. For manufactured piping systems, pressure/leak test in accordance with the manufacturer's standards.

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 1.5 times the normal operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Submit test and inspection reports.

3.14 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.

    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.15 CLEANING

A. Provide the following minimum cleaning and disinfecting procedures as follows. Notify the Engineer seven (7) days in advance of disinfection procedures.

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 11 16

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Drain valves.
8. Water hammer arresters.
9. Air vents.

1.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.03 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. 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.

B. NSF Compliance: Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

C. Lead Free Requirements: All plumbing pipes, fittings, valves, fixtures, and other components in systems providing water for human consumption shall be ‘lead-free’ in accordance with the “Reduction of Lead in Drinking Water Act” and the “Safe Drinking Water Act”, where the term ‘lead-free’ is defined to mean – “not containing more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.”

1. Lead-free products shall be compliant with the requirements of either NSF 61-G or NSF 372.

2. Lead-free products shall bear a certified mark by a nationally accredited certification body.

PART 2: PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze in mechanical or boiler room. Chrome plated in all other areas.

B. Pressure Vacuum Breakers:

1. Standard: ASSE 1020.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Size: Full line size as indicated on drawings.
5. Valves: Ball type, on inlet and outlet.

2.02 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers

1. Standard: ASSE 1013.

2. Operation: Continuous-pressure applications.

3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

4. Temperature Rating: Backflow preventer shall be selected to operate at maximum temperature allowable of connected equipment, i.e. approximately 200 degrees Fahrenheit for boilers to be verified with manufacturer prior to final selection.

5. Size: Full line size as indicated on drawings.

6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.

7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

8. Configuration: Designed specifically for horizontal or vertical flow as installed.

9. Accessories:

   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.03 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.

b. Watts Industries, Inc.; Water Products Div.
c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.

3. Pressure Rating: Initial working pressure of 150 psig.

4. Size: Full line size as indicated on drawing.

5. Design Flow Rate: Refer to drawings.

6. Design Inlet Pressure: Refer to drawings.

7. Design Outlet Pressure Setting: Refer to drawings.

8. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that is FDA approved for NPS 2-1/2 and larger.

9. Valves for Booster Heater Water Supply: Include integral bypass.

10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.04 BALANCING VALVES

A. Copper-Alloy and Stainless Steel Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Watts Industries, Inc.; Water Products Div.
b. Nibco, Inc.
c. Nexus Valves
d. HDi, Hydronic Components, Inc.

2. Type: Ball or Globe valve with two readout ports and memory setting indicator.

3. Body: Lead free brass, bronze or stainless steel.

4. Size: Same as connected piping, but not larger than NPS 2.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Flo Fab Inc.
c. Tour and Anderson, available through Victaulic Company of America
d. NIBCO INC.
e. Watts Industries, Inc.; Water Products Div.
f. Gerand Engineering, Co.
g. Taco, Inc.

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.

3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

2.05 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Point-of-Use, Thermostatic, Water Mixing Valves.

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

   a. Apollo Vavles, Conbrace Industries, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Powers; a Watts Industries Co.

2. Standard: ASSE 1016 and ASSE 1070.

3. Pressure Rating: 125 psig.

4. Type: Dual outlet, thermostatically controlled temperature limiting water mixing valve.

5. Material: Bronze body with PPO Noryl Shuttle, EPDM o-ring, wax-filled copper thermostat, 316 SS spring, and ABS handle.

6. Connections: Standard 7/8”

7. Accessories: Control knob, tamper resistant temperature limit stop, crush proof integral check valves, hot/cold water failure protection, cold water bypass for dual control faucets, and mounting bracket.

8. Tempered-water setting: 110°F.

2.06 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.

2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller;flanged for NPS 2-1/2 and larger.

4. Screen: Stainless steel with round perforations, unless otherwise indicated.

5. Drain: Factory-installed, hose-end drain valve.

2.07 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
4. Approved for installation with no access panel required.

PART 3: EXECUTION

3.01 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install ASSE 1070 compliant point-of-use thermostatic mixing valves at all lavatory and wash fountain fixtures and as indicated in Section 22 40 00 Plumbing Fixture Data Sheets for specific fixtures requiring a temperature limiting device.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

G. Install water hammer arresters in water piping according to PDI-WH 201 and at all flush valves.

H. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker and reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.04 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 11 19

SECTION 22 11 23

DOMESTIC WATER PUMPS

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:

1. Close-coupled, in-line, sealless centrifugal pumps.

1.02 SUBMITTALS

A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

1.03 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. 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.

C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

D. Lead Free Requirements: All plumbing pipes, fittings, valves, fixtures, and other components in systems providing water for human consumption shall be 'lead-free' in accordance with the "Reduction of Lead in Drinking Water Act" and the "Safe Drinking Water Act", where the term 'lead-free' is defined to mean – "not containing more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."

1. Lead-free products shall be compliant with the requirements of either NSF 61-G or NSF 372.

2. Lead-free products shall bear a certified mark by a nationally accredited certification body.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.

3. Grundfos Pumps Corp.
4. Taco, Inc.

2.02 CLOSE COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.

2. Casing: Bronze, with threaded companion-flange connections.

3. Impeller: Corrosion-resistant material.

4. Motor: Variable speed EC motor. Comply with Division 22 Section “Common Work Requirements for Plumbing Equipment”.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Install centrifugal pumps with motor and pump shafts horizontal.

E. Install continuous-thread hanger rods of sufficient size to support pump weight.

3.03 CONTROL INSTALLATION

A. Install immersion-type thermostats in hot-water return piping.

3.04 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."

1. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 11 23

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.02 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.03 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.04 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality control inspection and test reports.

1.05 QUALITY ASSURANCE

A. Comply with the following Codes and Standards:

1. Plumbing Code Compliance: Comply with applicable State Codes.
2. ASTM A 888: Standard Specifications for Hubless Cast Iron Soil Pipe and Fittings.
3. CISPI: Cast Iron Soil Piping Institute.
4. ASTM A 74: Standard Specifications for Hub and Spigot Cast Iron Soil Pipe and Fittings.
5. ASTM C 564: Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM C 1277: Standard Shielded Couplings for Hubless Cast Iron Pipe and Fittings.
7. ASTM C 1540: Heavy duty shielded couplings for Hubless Cast Iron Pipe and Fittings.

B. Piping material shall bear label, stamp, or other markings of specified testing agency.

C. All hubless cast iron DWV pipe and fittings shall be marked with Country of origin and identification of the original manufacturer.

PART 2: PRODUCTS

2.01 PIPING MATERIALS

A. Hubless Cast Iron Soil Pipe and Fittings: Conform to ASTM A888 and mark with the certified trademark of the independent third party certification agency.

1. Standard shielded couplings: Conform to ASTM C1277 assembly. Provide with stainless steel metal shield, stainless steel bands and tightening devices and ASTM C564 rubber sleeve with integral center pipe stop.

2. Heavy duty shielded couplings: Conform to ASTM C1540. Provide with stainless steel metal shield, stainless steel bands and tightening devices and ASTM C564 rubber sleeve with integral center pipe stop.

B. PVC sewer pipe and fittings. Conform to ASTM D2665 for pipe and fittings with solvent welded joints using solvents conforming to ASTM D2564. Primer color shall be purple to contrast with pipe and cement colors. Primer shall conform to ASTM F656.

PART 3: EXECUTION

3.01 PIPE APPLICATIONS

A. Above Ground: Install hubless cast iron soil pipe and fittings with heavy duty shielded couplings.

B. Below Ground: Install PVC sewer pipe and fittings or cast iron pipe and hubless fittings with stainless steel bands.

3.02 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

E. Review soil testing information provided to verify conditions are suitable for piping installations.

F. Do not proceed until unsatisfactory conditions have been corrected.

3.03 UNDERGROUND PIPE INSTALLATION

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

C. Shape bottom of trench to fit bottom ½ of the circumference of pipe. Fill unevenness with tamped granular sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

D. Install underground building drains to conform with State Plumbing Code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual and Handbook. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

E. Backfill trench with clean sand or gravel. Removed trench soil may be used as backfill if suitable compaction can be obtained.

F. Install building drain pitched down at minimum slope of 1/4" per foot (2 percent). Where site conditions preclude this slope, pipes 4-inch and larger may be sloped at 1/8" per foot (1 percent). Notify Engineer of site conditions that do not allow sloping of pipe at ¼" per foot. Approval from authority having jurisdiction is required prior to proceeding with the Work.

G. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 2.

H. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

I. Install 1" thick extruded polystyrene over underground building drain piping not under building. Width of insulation shall extend minimum of 12" beyond each side of pipe. Install directly over, and center on pipe center line.

J. Make changes of direction using appropriate 45 degree wyes or long sweep bends. No change of direction in flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

3.04 JOINING PIPES AND FITTINGS

A. Cast-Iron Soil Pipe: Hubless joints shall be supported and restrained in accordance with ASTM 1540/CISPI 310 standards.

B. Soldered Joints: Use ASTM B813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder, and ASTM B828 procedures, unless otherwise indicated.

3.05 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Install individual, straight, horizontal piping runs: MSS Type 1, adjustable, steel clevis hangers.

3. Multiple, Straight, Horizontal Piping Runs: MSS SP-69 and MSS SP-89, field-fabricated trapeze pipe hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor. Support vertical cast iron piping at a minimum of every 15 feet. Support vertical copper tubing at a minimum every 10 feet.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers with the following minimum rod sizes and maximum spacing in accordance with state code. For cast iron pipe. Install hangers at each branch connection and at every joint unless over 4-feet, then at each joint.

Nom. Pipe Size – Inches	Cast Iron Pipe Max. Span – Feet	Copper Tube Max. Span – Feet	Min. Rod Dia. – Inches
Up to 3/4	–	5	3/8
1	–	6	3/8
1¼	7	6	3/8
1½	9	6	3/8
2	10	8	3/8
2½	10	9	3/8
3	10	10	3/8
4	10	10	5/8
5	10	10	5/8

6	10	10	3/4
8	10	10	7/8
10	10	10	7/8
12	10	10	7/8

F. The following additional cast iron hanger requirements shall apply:

1. Support adjacent to joint, not to exceed 18 inches.
2. Brace not to exceed 40 foot intervals to prevent horizontal movement.
3. Support at each horizontal branch connection.
4. Hangers shall not be placed on the coupling.

G. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

3.07 FIELD QUALITY CONTROL

A. Inspections:

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests in accordance with State and Local code requirements in the presence of the plumbing official.

a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the State Plumbing Code.

3. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.

4. Reports: Prepare inspection reports, signed by the plumbing official.

B. Piping System Test:

1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

3. In the absence of State or Local code requirements, the following minimum level of testing shall be performed. Drainage and Venting System Testing Procedures:

a. Rough Plumbing: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation as follows:

1) Cast Iron Piping Systems:

a) Attach an air compressor or testing apparatus to any suitable opening and close all other inlets and outlets to the system by means of proper testing plugs. Plaster of paris shall not be used in roof terminals. Air shall be forced into the system until there is a uniform pressure of five pounds per square inch on the portion of the system being tested. The pressure shall remain constant for 15 minutes without the addition of air.

2) Thermoplastic Piping Systems:

a) Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts through completion of the inspection. Inspect all joints for leaks. The contractor shall pre-test the systems with air when necessary to avoid possible damage to finished materials and surfaces.

b. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

4. Repair all leaks and defects using new materials and re-test system or portion thereof until satisfactory results are obtained.

5. Prepare reports for all tests and required corrective action.

3.08 ADJUSTING AND CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

C. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

D. Place plugs in ends of unoccupied piping at end of day and when work stops.

3.09 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION 22 13 16

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Through-penetration firestop assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. Flashing materials.

1.02 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Floor drains.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.05 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2: PRODUCTS

2.01 CLEANOUTS

A. Metal Cleanouts:

1. Standard: ASME A112.36.2M cast iron for cleanout test tee.

2. Size: Same as connected drainage piping.

3. Body Material: Match connected piping material and connection method.

4. Closure: Countersunk plug.

5. Options – Floor Cleanouts

   a. Closure: Brass plug with straight threads and gasket.

   b. Adjustable Housing Material: Cast iron with threads.

   c. Frame and Cover Material:

      1) Finished Areas: Polished bronze.
      2) Unfinished Areas: Rough bronze.
      3) Carpeted Areas: Stainless steel carpet marker with vandal proof screw.

6. Options – Wall Cleanouts

   a. Closure: Countersunk brass plug.
   b. Closure Size: Same as cleanout size.
   c. Wall Access: Round, flat, chrome plated brass coverplate with screw.

2.02 FLOOR DRAINS

A. Subject to compliance with requirements, provide drainage systems from one of the following:

1. Josam Mfg. Co.
2. Smith (Jay R) Mfg. Co.
3. Wade, Subs. of McWane
4. Zurn Industries Inc,; Hydromechanics Div.
5. Watts Regulator Company
6. Mifab

B. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein: (Typical units listed below are of Josam manufacture).

C. Floor Drain Type FD-1: Coated cast iron floor drain of the size indicated on the plans, with double drainage flange, invertible non-puncturing flashing collar, weepholes, bottom outlet, and adjustable satin nikaloy round "Super-Flo" strainer of 6 inch diameter or as indicated on drawings. Josam Series No. 30000-A.

1. These drains are for use in toilet rooms, showers, service sinks and other finished areas.

D. Floor Drain Type FD-2: Coated cast iron floor drain of the size indicated on the plans, with double drainage flange, invertible non-puncturing flashing collar, weepholes, bottom outlet, and adjustable bronze round "Super-Flo" strainer of 6 inch diameter or as indicated on drawings. Josam Series No. 30000-A-2.

1. These drains are for use in mechanical rooms and other unfinished areas.

2. Drain shall be installed with a deep seal trap.

2.03 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

B. Description: Manufactured assembly made of 6.0-lb/sq. ft. thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

a. NPS 2: 4-inch minimum water seal.
b. NPS 2-1/2and Larger: 5-inch minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

2.05 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.

2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.

3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.

2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3: EXECUTION

3.01 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

5. Locate where there is an increase in pipe size.

6. Locate at new to existing piping connections.

7. Locate at fixtures that are common vented at the same level.

8. Locate at upper most terminal of horizontal drains where traps are concealed, so that all lines are accessible for cleaning.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install vent caps on each vent pipe passing through roof.

L. Install wood-blocking reinforcement for wall-mounting-type specialties.

M. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Coping and Flashing."

F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 33 00

ELECTRIC DOMESTIC WATER HEATERS

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following electric water heaters:

1. Commercial, storage electric water heaters.
2. Expansion tanks.
3. Water heater accessories.

1.02 SUBMITTALS

A. Provide product data for each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories. Include power, signal, and control wiring diagram.

1.03 CLOSEOUT DOCUMENTATION

A. Maintenance Manuals: Submit maintenance manuals in accordance with Division 1 Section "Operating, Maintenance, and Warranty Data".

B. Submit field quality control reports.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.

B. 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.

C. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.05 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

PART 2: PRODUCTS

2.01 COMMERCIAL ELECTRIC WATER HEATERS

A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.

1. Manufacturers:

a. Lochinvar Corporation.
b. PVI Industries, LLC.
c. Rheem Water Heater Div.; Rheem Manufacturing Company.

d. Ruud Water Heater Div.; Rheem Manufacturing Company.
e. Smith, A. O. Water Products Company.
f. State Industries, Inc.

2. General: Provide water heater of the size, capacity, and configuration as indicated on the drawings. Provide with features as indicated.

3. Storage-Tank Construction: ASME-code, steel construction.

a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. Pressure Rating: 150 psig.

c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Provide anode rods of the appropriate material as required for the water conditions at the building.

b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

c. Insulation: Comply with ASHRAE/IESNA 90.1.

d. Jacket: Steel with enameled finish.

e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.

1) Staging: Input not exceeding 18 kW per step.

f. Temperature Control: Adjustable thermostat.

g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.

h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

6. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.

2.02 EXPANSION TANKS

A. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

1. AMTROL, Inc.
2. A.O. Smith Corp
3. Armstrong Pumps
4. Bell & Gossett, a Xylem brand.

5. Grundfos.
6. State Industries, Inc.
7. Taco, Inc.
8. Watts Regulator
9. Wessels Co.

B. Description: Steel, ASME rated, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

C. Construction:

1. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
2. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
3. Air-Charging Valve: Factory installed.

D. Capacity and Characteristics unless otherwise indicated on the drawings.

1. Working-Pressure Rating: 150 psig.
2. Capacity Acceptable: 4 gal. minimum.
3. Air Precharge Pressure: 60 psig.

2.03 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.

C. Water Heater Stand and Drain-Pan Units: High-density-polyethylene-plastic, 18-inch- high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.

D. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

E. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

F. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig- maximum outlet pressure, unless otherwise indicated.

G. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

2.04 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3: EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.

2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

F. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

G. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

H. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

I. Fill water heaters with water.

J. Charge compression tanks with air.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

3.03 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain electric water heaters. Refer to Division 01 Section "Demonstration and Training."

1. Required Time: 1 hour.

END OF SECTION 22 33 00

SECTION 22 40 00

PLUMBING FIXTURES

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes:

1. Water closets
2. Lavatories
3. Stainless steel sinks
4. Faucets
5. Drains
6. Wastes
7. Water coolers
8. Supplies with angle stops
9. Point of use mixing valves

B. Products installed but not furnished under this Section include:

1. Accessories, appliances, appurtenances, and equipment specified in other sections, requiring plumbing services or fixture- related devices, as indicated.

1.02 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.03 SUBMITTALS

A. Product data for each type of plumbing fixture specified, including fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details, dimensions of components, and finishes.

B. Wiring diagrams for field-installed wiring of electrically operated units.

C. Color Charts

D. Operation and Maintenance Data: For plumbing fixtures to includes emergency operation and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. 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.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" as required by State Code for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Lead Free Requirements: All plumbing pipes, fittings, valves, fixtures, and other components in systems providing water for human consumption shall be 'lead-free' in accordance with the "Reduction of Lead in Drinking Water Act" and the "Safe Drinking Water Act", where the term 'lead-free' is defined to mean – "not containing more than 0.2 percent lead when used with respect to solder and flux; and not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."

1. Lead-free products shall be compliant with the requirements of either NSF 61-G or NSF 372.

2. Lead-free products shall bear a certified mark by a nationally accredited certification body.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
3. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
4. Vitreous-China Fixtures: ASME A112.19.2M.
5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
6. Water-Closet, Flushometer Tank Trim: ASSE 1037.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.

10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.
13. Point-of-Use Thermostatic Mixing Valves: ASSE 1070.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Manual-Operation Flushometers: ASSE 1037.
4. Plastic Tubular Fittings: ASTM F 409.
5. Brass Waste Fittings: ASME A112.18.2.
6. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Hot-Water Dispensers: ASSE 1023 and UL 499.
6. Off-Floor Fixture Supports: ASME A112.6.1M.
7. Pipe Threads: ASME B1.20.1.
8. Plastic Shower Receptors: ANSI Z124.2.
9. Plastic Toilet Seats: ANSI Z124.5.
10. Supply and Drain Protective Shielding Guards: ICC A117.1. ASTM E-84 with a flame index under 25 and smoke index of not more than 450.

1.05 WARRANTY

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

1. Warranty Period for Commercial Applications: One year from date of Substantial Completion.

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

3. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.

4. Flushometer Tank, Repair Kits: Equal to 5 percent of amount of each type installed, but no fewer than 2 of each type.

5. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.

6. Toilet Seats: Equal to 5 percent of amount of each type installed.

7. Electric Water Cooler Strainers: Equal to 100 percent of the amount installed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.

B. Store plumbing fixtures on elevated platforms in a dry location.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following for each fixture type or component listed.

1. Vitreous China Fixtures:

    a. American Standard
    b. Crane
    c. Eljer
    d. Kohler
    e. Zurn One
    f. Sloan

2. Stainless Steel Counter Sinks:

    a. Elkay
    b. Just

3. Faucets (Manual):

    a. Chicago
    b. Delta
    c. Zurn Aqua Spec
    d. T&S Brass

4. Faucets (Automatic):

    a. Chicago
    b. Delta
    c. Sloan
    d. Zurn

5. Water Cooler:

    a. Halsey-Taylor
    b. Elkay

6. ADA Trap Wrap:

    a. Truebro
    b. Handi Lav-Guard
    c. Brocer Products
    d. Trap Wrap
    e. Pro Wrap
    f. Zurn
    g. Proflo

7. Toilet Seats:

    a. Church
    b. Bereke
    c. Olsonite
    d. Sperzel
    e. Centoco
    f. Proflo
    g. Zurn
    h. Bemis

8. Plumbing Supports:

    a. Josam
    b. Wade
    c. Smith
    d. Zurn
    e. Watts
    f. Mifab

9. Traps and Supplies:

    a. Zurn Traps and Supplies
    b. Chicago
    c. Brass Craft
    d. Central
    e. Royal
    f. Dearborn
    g. T&S
    h. Keeney

2.02 PLUMBING FIXTURES, GENERAL

A. Provide plumbing fixtures and trim, fittings, other components, and supports as specified in "Plumbing Fixture Data Sheets" at the end of Part 3 of this Section.

B. Provide plumbing fixtures and trim, fittings and other components that are certified in accordance with NSF 61 and NSF Annex G to contain less than 0.25% lead content, for all products in contact with drinking water.

2.03 FAUCETS

A. Faucets General: Unless otherwise indicated, provide faucets that are solid, one piece cast brass with polished, heavy chrome-plate finish conforming to ASME A-112.18.1M. Lead content shall be less than 0.25%.

2.04 FITTINGS, EXCEPT FAUCETS

A. Fittings General: Unless otherwise specified, provide fitting fabricated of brass, with polished heavy chrome plate finish.

B. Escutcheons: Wall flange with set screw or sheet steel wall flange with friction clips, of depth adequate to conceal protruding roughing-in fittings.

2.05 SUPPLIES WITH ANGLE STOPS

A. Construction: Polished chrome plated solid brass construction. Plastic stems are not allowed.

B. Cartridge: Ball valve.

C. Supply Riser: 3/8” O.D. x 12” flexible copper, chrome plated supply riser.

D. Handle: Removable, chrome plated, 2 ¼” metal loose key tee.

E. Escutcheon: Chrome plated metal wall flange.

F. Performance:

1. 20-125 psi rated operating pressure.
2. 40-140°F rated operating temperature.

G. Codes: ASME A112.18.1M.

2.06 TOILET SEATS

A. General: Provide toilet seats compatible with water closets, and of type, color, and features indicated.

B. Toilet Seats: Heavy-duty, commercial/industrial type, elongated, open front, solid plastic, with self-sustaining check hinge, less cover.

2.07 WATER FILTER FOR WATER COOLERS

A. Capacity of 3000 gallons, 1.5 GPM, 105 psi. Conform to NSF/ANSI 42 and 53 for chlorine taste, odor, particulate Class 1 and lead reduction. Filter shall be integral to water cooler and installed in the factory.

2.08 PLUMBING FIXTURE SUPPORTS

A. Supports: ASME A112.6.1M, categories and types as required for wall-hanging fixtures specified, and wall reinforcement.

B. Support categories are:

1. Sink or Similar Fixture Carriers: Supports for wall-hanging sinks, lavatories or similar fixtures. Provide floor-mounted welded feet and supports with steel uprights and concealed arms. Provide with leveling and securing screws. Verify arm type with fixture.

2. Water Cooler Carrier: Supports for wall hanging water cooler. Provide floor mounted welded feet and supports with steel uprights, upper hanger plate, lower bearing plate, adjustable rods and chrome plated trim. Provide bi-level type for bi-level water cooler.

3. Reinforcement: 2-inch by 4-inch wood blocking between studs or 1/4-inch by 6-inch steel plates attached to studs, in wall construction, to secure floor-mounted and special fixtures to wall.

C. Support Types: Provide support of category specified, of type having features required to match fixture.

D. Provide supports specified if a part of fixture description, in lieu of category and type requirements above.

E. Subject to compliance with requirements, provide plumbing fixture supports from one of the following:

1. Josam Mfg. Co.
2. Smith (Jay R.) Mfg. Co.
3. Wade; Subs of Tyler Pipe Corp.
4. Zurn Industries; Hydromechanics Division
5. Watts Drainage
6. Mifab

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for potable cold water and hot water supplies and soil, waste, and vent piping systems to verify actual locations of piping connections prior to installing fixtures.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 APPLICATION

A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings.

B. Install supports for plumbing fixtures in accordance with categories indicated, and of type required:

1. Chair carriers for the following fixtures:

    a. Wall-hanging lavatories and sinks.
    b. Wall-hanging drinking fountains and electric water coolers.

2. Reinforcement for the following fixtures:

    a. Floor-mounted lavatories required to be secured to wall.

3.03 INSTALLATION OF PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers' written installation instructions, roughing- in drawings, and referenced standards.

B. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

C. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.

D. Fasten floor-mounted fixtures and special fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

E. Fasten wall-mounted fittings to reinforcement built into walls.

F. Fasten counter-mounting-type plumbing fixtures to casework.

G. Secure supplies behind wall or within wall pipe space, providing rigid installation.

H. Install stop valve in an accessible location in each water supply to each fixture.

I. Install trap on fixture outlet except for fixtures having integral trap.

J. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.

K. Seal fixtures to walls, floors, and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant in accordance with sealing requirements specified in Division 7. Match sealant color to fixture color.

3.04 CONNECTIONS

A. Piping installation requirements are specified in other sections of Division 22. The Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.

2. Install piping connections indicated between appliances and equipment specified in other sections, direct connected to plumbing piping systems.

3.05 POWER CONNECTIONS

A. The Division 26 Contractor will provide a 120/1 Volt power connection to a single location in each room where powered sensors/fixtures are required.

B. The Division 22 Contractor shall provide the quantity of transformers recommended by the fixture manufacturer. All required low voltage wiring, conduit, junction boxes, and transformer installation shall be provided by the Mechanical Contractor in accordance with Division 26 requirements.

3.06 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.07 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at electric water coolers and faucets having controls to provide proper flow and stream.

C. Replace washers or cartridges of leaking and dripping faucets and stops.

D. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

E. Review the data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout."

3.08 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities, except when approved in writing by the Owner.

3.09 FIXTURE SCHEDULE

A. Provide plumbing fixtures as scheduled on the following "Data Sheets." Each Data Sheet begins with a new page.

ADA FLUSH TANK WATER CLOSET DATA SHEET

WATER CLOSET: American Standard, Cadet, No. 215AA.004

Applicable Standard: ANSI-A112.19.2M

Material: Vitreous China bowl and bolt caps

Bowl Type: Elongated, Siphon jet with close coupled tank

Mounting and Outlet: Floor mounted, floor outlet

Rim Height: 16 ½ inches (Refer to Architectural elevations)

Color: White with white seat

Fittings and Accessories: Provide the following compatible components:

Toilet Seat: Bemis 1955SSCT, white (less cover), and self-sustaining check hinges.

Supply: Chicago No. STB-21-00 ¼ turn ball stop with loose key handle and end caps.

ADA LAVATORY DATA SHEET

LAVATORIES: American Standard, Lucerne, No. 0355.012

Applicable Standard: ANSI-A112.19.2M

Material: Vitreous China

Lavatory Type: Self-draining deck with contoured back and side splash shields

Dimension: 20"w x 18"d, 4" fixed centers

Mounting and Outlet: Wall hanging. Refer to Architectural details.

Color: White

Fitting and Accessories: Provide the following compatible components:

Supplies: (2) Chicago No. STB-21-00 ¼ turn ball stop with loose key handle and end caps.

Faucet (battery): Sloan Optima Model EBF-187, 4" center set, deck mounted, electronic sensor operated, polished chrome plated finish with metal throat plate, hot and cold water solenoid valves, below deck thermostatic mixing valve with integral back check stops, and 0.5 GPM vandal proof aerator. Provide adaptive sensor, batteries, serviceable filtered solenoid valve, and trim plate with anti-rotation pin. All low voltage wiring is the responsibility of the mechanical contractor.

Drain: Chrome grid strainer

Trap: Exposed chrome with wall escutcheon

Support: Chair carrier, concealed arms

Mixing Valve: Chicago series 131 ASSE 1070 thermostatic mixing valve or equal. Provide one mixing valve for each fixture.

Protective Enclosure: Sloan Model ETF-529, or equal, ADA compliant, high impact white molded rigid vinyl protective enclosure for trap and sensor control devices. The enclosure shall attach to the wall with screw fasteners, field cut as required to match installed conditions.

SINGLE ELECTRIC WATERCOOLER DATA SHEET

ELECTRIC WATER COOLER: Elkay Model EZS8WSSK

Applicable Standard: ADA/ICC A117.1 / NSF/ANSI 61, 372 / UL 399

Material/Finish: Stainless steel

Water Cooler Type: Refrigerated, ADA accessible

Mounting: Wall mount, with non-recessed refrigeration system below fountain and bottle filling station and filter; provide mounting hardware.

Rim Height: Refer to Architectural elevations.

Capacity: 8.0 GPH at 30 deg. water temperature drop, 90 deg. ambient air temperature.

Fittings and Accessories: Provide the following compatible components:

Supplies: (1) Chicago No. STB-21-00 ¼ turn ball stop with loose key handle and end cap

Valve Operator: Self-closing, with front push bar operator

Bubbler: Flexi-Guard stream saver

Bottle Filler: No-touch sensor activated with 20 second shut-off timer. Shall meet ADA guidelines for front and parallel approach.

Cane Apron: ADA compliant cane apron. Provide finish to match water cooler.

Strainer: Removable, chrome-plated brass. Built-in 100 micron.

Support: Provide wall reinforcement.

Trap: 1¼" IPS cast brass P-trap with 17 gauge waste to wall.

ADA COUNTER SINK DATA SHEET

SINK: Elkay Lustertone, LRAD-1918

Applicable Standard: ASME A112.19.3 / ADA ANSI/ICC A117.1

Material: Type 304 nickel bearing stainless steel

Gage: 18 ga.

Sink Type: Single Compartment Counter sink

Dimensions: 19"l x 18"w x 5½"d

Mounting and Outlet: Counter mounted. Locate the drain at the rear of the sink basin offset to one side.

Color or Finish: Satin, bright metal

Fittings and Accessories: Provide the following compatible components:

Supplies: (2) Chicago No. STB-21-00 ¼ turn ball stop with loose key handle and end caps.

Faucet: Chicago No. 434-ABCP single-hole mount deck-mounted faucet with pull-down spout, 1.5 GPM dual-pattern outlet, ¼ turn ceramic operating cartridges.

Mixing Valve: Chicago series 131 ASSE 1070 thermostatic mixing valve or equal. Provide one mixing valve for each fixture.

Drain: Elkay LK-35, 3-1/2" stainless steel body with removable conical basket strainer with metal stem and rubber stopper with 1-1/2" tailpiece.

Trap: Concealed within cabinet, chrome waste with wall escutcheon

Support: Self-rimming

END OF SECTION 22 40 00

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Transition fittings
2. Dielectric fittings
3. Pipe sleeves
4. Sleeve seals
5. Escutcheons.
6. Grout.
7. HVAC demolition.
8. Equipment and system-common requirement.
9. Painting.
10. Concrete bases.
11. Supports and anchorages.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.03 SUBMITTALS

A. Welding certificates.

1.04 QUALITY ASSURANCE

A. Product and Material Origin: All materials and products shall be manufactured within the 12 months of delivery to the site. Provide factory certified verification of the date of manufacture upon request form the Engineer.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. Storage of materials and equipment shall not impede the work of other contracts.

D. Handling of equipment and products shall be according to manufacturer’s instructions and incompliance of their warranty.

E. Protect products from weather, unless the product is slated for exterior installation. If outdoor support is necessary, support products off the ground or pavement in water tight enclosures.

1.06 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for system installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for system requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.07 PRODUCT SUBSTITUTIONS

A. Equipment manufacturer’s where indicated on the drawings are the basis for design. The contractor accepts responsibility for all design implications when providing approved equipment other than the design basis.

B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics than the basis of design may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

C. Dimensional and Weight Changes: Equipment with dimensions or weight different than the basis of design may be furnished provided such proposed equipment is approved in writing. The contractor is responsible for verifying proposed equipment maintains the design intent for access and serviceability and reserves space for future equipment where required. Cost implications to other trades are the responsibility of the contractor.

1.08 INTERPRETATION OF PLANS

A. In general, the Drawings are to scale. However, to determine exact locations of walls and partitions, the Contractor shall consult the architectural and/or structural Drawings which are dimensioned. Drawings shall not take precedence over field measurements.

B. Drawings are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail of construction. All work shall be constructed from field measurements taken at the site. This shall include all rises, drops and offsets necessary to avoid structural members or equipment and materials installed by other trades. The contractor shall coordinate the ductwork and piping layout before construction. No additional costs will be allowed for piping and ductwork fabrications without field verification of available space. If it is found, before installation, that a more convenient, suitable or workable arrangement of any or all phases of construction would result by altering the arrangement indicated on the Drawings, the architect/engineer may require the contractor to change the arrangement of his work without additional cost to the owner.

C. The drawings and specifications are intended to supplement each other. Any items shown on the drawings and not mentioned in the specifications, or vice versa, shall be executed the same as if mentioned and shown.

D. The greatest quantity or more expensive work shall govern where there is a conflict noted anywhere on the drawings and/or specifications.

1.09 COORDINATION DRAWINGS

A. Review contract documents and prepare coordination drawings as an informational submittal in accordance with Division 1 requirements. Provide drawings of all areas of the project. Architectural backgrounds of the building will be made available upon request. Detailed mechanical drawings will not be made available. Facilitate coordination meetings and revise drawings as required to resolve work conflicts. Conflicts between trades or existing conditions that arise due to work not being coordinated prior to installation shall be resolved at no cost to the Owner.

B. The Division 23 contractor shall coordinate the preparation of drawings by other trades including steel, precast concrete, fire protection, lighting, plumbing, piping, and building sound systems. The Division 23 contractor shall create composite drawings showing the work of all other trades. The Division 23 contractor shall facilitate coordination meetings as scheduled and coordinated by the General Contractor or Construction Manger to review potential conflicts and propose specific solutions. Any proposed revisions to the Contract Documents shall be noted on the coordination drawings for review by the Architect and Engineer.

C. The composite drawings of all trades shall detail all structural building elements, mechanical equipment, and work of other trades. Indicate locations where space is limited for installation, access for service, and where sequencing and coordination of installations are of importance to the efficient flow of work. The composite drawings shall include at a minimum the following. Where required for clarity multiple composite drawings may have to be submitted for each area.

1. Clearances for installing and maintaining insulation.

2. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

3. Equipment connections and support details.

4. Exterior wall and foundation penetrations.

5. Fire-rated wall and floor penetrations.

6. Sizes and locations of required concrete pads and bases.

7. Valve stem movement.

8. Dimensional locations of pipe sleeves passing through floor/roof slabs.

9. Locations of wall and ceiling access panels where required for access to mechanical equipment.

10. Reflected ceiling plans to integrate installations of light fixtures, grilles, registers, and diffusers, sprinklers, communication systems, and other ceiling mounted components.

11. Both new and existing structural elements.

1.10 COST BREAKDOWN

A. Submit a cost breakdown for each claim according to General Conditions of the Contract. Include project name, location, Architect/Engineer, Contractor and date.

1. List the cost breakdown for labor and material separately and include a total.

2. Breakout and detail the cost according to specification sections.

1.11 UTILITY REBATES

A. Prepare and submit utility rebate application forms and supporting documentation that are applicable within the scope of this project. Coordinate submittal with the project engineer and Owner’s representative.

1.12 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "Project Record Documents." In addition to the requirements specified in Division 1, refer to specific sections for additional record documentation.

1.13 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "Operating, Maintenance, and Warranty Data". Submit copies for review by Architect/Engineer. In addition to the requirements specified in Division 1, include the following information:

1. Descriptive summary of function, normal system operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

5. Warranty information for all mechanical items shall be included in one tabbed section.

1.14 FIRE SAFETY PRECAUTIONS

A. The Contractors shall exercise extreme care to maintain and exercise adequate fire safety precautions throughout the work. This shall include providing sufficient fire fighting devices, watchmen, standby helpers or other precautions during construction, in use of temporary heat, welding, brazing, sweating, testing or other phases of work.

B. At all times, access shall be maintained for fire department trucks to the building.

C. All welding brazing, cutting and sweating operations performed in vicinity of or accessible to combustible materials shall be adequately protected to make certain that sparks or hot slag does not reach the combustible material and start a fire.

D. All glass, glazed materials and other finish, in the vicinity of welding, brazing and cutting, shall be masked by the Contractor performing the welding work.

E. When necessary to do cutting, welding, brazing, sweating and similar work in vicinity of wood, in shafts, or vicinity of any combustible material (and the combustible material cannot be removed), the materials shall be adequately protected with fire resistant blankets or similar approved coverings. In addition, a helper shall be stationed nearby with proper fire extinguishers (provided by the Contractor performing the work) to guard against sparks and fire.

F. Whenever combustible materials have been exposed to sparks, molten metal, hot slag or splatter, a person shall be kept at the place of work to make sure the smoldering fires have not been started. Whenever cutting or welding operations are carried on in a vertical pipe shaft, a person to act as a fireguard shall be employed to examine all floors below the point of cutting or welding. This fireguard shall be kept on duty after completion of work to guard against fires and shall examine each level after this time, prior to leaving. There shall be no exceptions to this requirement and failure to comply will be construed as negligence.

1.15 PERSONAL SAFETY REQUIREMENTS

A. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions required in connection with his work, including regulations of the Occupational Safety and Health Administration (OSHA) and other governing agencies.

1.16 TESTING, ADJUSTING AND BALANCING

A. All mechanical systems shall be balanced by an independent test and balance agency contracted directly by the Division 23 Contractor. The scope of the testing and balancing work includes functional performance testing of all mechanical systems. Refer to specification section "Testing, Adjusting, and Balancing".

B. The Contractor shall be certain that all systems are ready for proper operation prior to balancing and adjusting with clean filter and other system elements, e.g., coils. Temperature control calibration, electrical interface, etc., shall also be complete prior to balancing and adjusting. All equipment shall be freshly oiled. The Contractor shall instruct his employees and subcontractors to leave all balancing devices in a wide open position and free all operating arms and adjustments so that they can be easily operated. The contractor shall write a letter to the testing agency indicating that each of the areas defined by the construction schedule is complete and ready for balancing.

C. The Contractor shall provide copies of all submittals for air handling and hydronic equipment to the Balancing Contractor prior to starting balancing.

1.17 TEMPORARY HEAT/EQUIPMENT OPERATION

A. Provide temporary gas meter and connections to equipment provided by the General Contractor as required for temporary heat.

B. Warranties:

1. The Contractor shall provide extended warranties for all equipment and mechanical system components operated prior to the date of substantial completion. The Contractor shall obtain in writing from the manufacturer extended warranties for all equipment such that the Owner's warranty starts at the date of substantial completion in accordance with the General Division 1 requirements. Any additional costs shall be the burden of the Contractor.

C. Temporary Air Handling Equipment Operation:

1. Manually operate air-handling systems to provide suitable environment for installation of interior finishes. Provide factory start-up of all variable speed drives. Perform commissioning operations prior to starting units and operate the systems in accordance with the following procedures for manually operating the air handling systems. The Contractor shall obtain in writing from the manufacturer extended warranties for all affected equipment. Any additional costs shall be the burden of the Contractor:

a. The air handling systems shall not be operated at outside air temperature below 40.0 degrees. Open outdoor air dampers, close return air dampers, open all air terminals to full open, install filters, ensure condensate drain is functioning and electrical protection devices are installed. Start fan, monitor indoor and outdoor conditions, and operate heating and cooling systems to control space conditions; shut down systems completely and close outdoor air dampers at end of each workday. Return/exhaust fans shall not run during temporary operation.

D. Temporary Condensing Unit Operations:

1. The condensing units may be used for maintaining a suitable environment for the installation of interior finishes. The condensing unit installation must be complete in accordance with all manufacturer guidelines. Provide start-up services by an authorized factory representative. The contractor shall obtain in writing from the manufacturer extended warranties for all affected equipment. Any additional costs shall be the burden of the contractor.

1.18 PERMITS, LICENSES AND FEES

A. The Contractor shall secure all permits and licenses, both temporary and permanent required for their work. The Contractor shall pay all fees and expenses required for the permits and licenses.

1. The Contractor shall make all arrangements with each utility company and pay all service charges associated with new services or modifications to existing services.

2. The Contractor shall request inspections as required by regulating agencies and/or regulations. The Contractor shall pay all charges for inspections.

3. Contractor shall furnish the Owner with a certificate of final inspection and approval by enforcement authorities.

4. Comply with requirements of Division 00.

1.19 CORRECTIVE PERIOD / GUARANTEE

A. The Contractor shall guarantee and maintain the stability of work and materials and keep same in perfect repair and condition for the period of one (1) year after the Date of Substantial Completion of the Project.

B. Defects of any kind due to faulty work or materials appearing during the above mentioned period must be immediately made good by the Contractor at his own expense to the entire satisfaction of the Owner and Architect and Engineer Such reconstruction and repairs shall include damage to the finish or the building resulting from the original defect or repairs thereto.

C. The guarantee shall not apply to injuries occurring after final acceptance and due to wind, fire, violence, abuse or carelessness or other Contractors or their employees of the agents of the Owner.

D. This guarantee shall not apply where other guarantees for different lengths of time are specifically called for.

PART 2: PRODUCTS

2.01 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Plastic-to-Metal Transition Fittings: One-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D. Plastic-to-Metal Transition Unions: MSS SP-107, four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.02 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 300 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.03 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

2.05 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening. Provide brass material with polished chrome plated finish.

2.06 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, drain, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

5. Equipment to Be Removed: Disconnect and cap services and remove equipment.

6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Lead Containing Materials: The existing building may contain lead-containing materials, including lead paint. It is the Contractor's responsibility to meet all governmental regulations when dealing with the disposing of lead containing materials.

E. Remove from building site debris, rubbish, fluids, and other materials resulting from demolition operations. Transport and legally dispose of offsite.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on project site.

3.02 EQUIPMENT AND SYSTEM INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install transition fittings where necessary to accommodate installed materials of construction.

F. Install dielectric fittings at all metallic joints of dissimilar metal.

G. Install chrome plated brass escutcheons for penetrations of walls ceilings, and floors that are not concealed above a ceiling.

3.03 PIPE SLEEVE INSTALLATION

A. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. For pipes penetrating gypsum-board partitions: Schedule 40 steel pipe sleeves or steel sheet sleeves.

b. For all penetrations other than gypsum board partitions: Cast iron sleeves or Schedule 40 steel sleeves.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Flashing" for flashing.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Sealants and Caulking" for materials and installation.

B. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install Schedule 40 galvanized steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

C. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Firestopping" for materials.

E. Verify final equipment locations for roughing-in.

F. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.04 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.05 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.08 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 23 05 00

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1: GENERAL

1.01 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

D. All motors driven by a variable frequency PWM drive shall include a factory-mounted, maintenance free, circumferential, conductive micro fiber AEGIS SGR Bearing Protection Ring to discharge shaft currents to ground.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Sleeve type bearings permitted for fractional hp (less than ½ hp) light duty applications.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

5. Shaft Grounding: Provide integral shaft grounding as manufactured by Aegis.

C. Efficiency: Motor efficiency shall meet, at a minimum, the efficiency requirements of the most current NEMA premium efficiency standard. Motors shall be tested in accordance with IEEE Standard 112, test method B. Motor efficiencies are based upon the NEMA MGI-1987, Table 12-6B (as referenced in the State Energy Code) plus 2.5%.

MINIMUM MOTOR EFFICIENCY TABLE

	Open Motors				**Enclosed Motors**			
HP	3,600	1,800	1,200	900	3,600	1,800	1,200	900
1	77.0	85.5	82.5	74.0	77.0	85.5	82.5	74.0
1.5	84.0	86.5	86.5	75.5	84.0	86.5	87.5	77.0
2	85.5	86.5	87.5	85.5	85.5	86.5	88.5	82.5
3	85.5	89.5	88.5	86.5	86.5	89.5	89.5	84.0
5	86.5	89.5	89.5	87.5	88.5	89.5	89.5	85.5
7.5	88.5	91.0	90.2	88.5	89.5	91.7	91.0	85.5
10	89.5	91.7	91.7	89.5	90.2	91.7	91.0	88.5
15	90.2	93.0	91.7	89.5	91.0	92.4	91.7	88.5
20	91.0	93.0	92.4	90.2	91.0	93.0	91.7	89.5
25	91.7	93.6	93.0	90.2	91.7	93.6	93.0	89.5

30	91.7	94.1	93.6	91.0	91.7	93.6	93.0	91.0
40	92.4	94.1	94.1	91.0	92.4	94.1	94.1	91.0
50	93.0	94.5	94.1	91.7	93.0	94.5	94.1	91.7
60	93.6	95.0	94.5	92.4	93.6	95.0	94.5	91.7
75	93.6	95.0	94.5	93.6	93.6	95.4	94.5	93.0
100	93.6	95.4	95.0	93.6	94.1	95.4	95.0	93.0
125	94.1	95.4	95.0	93.6	95.0	95.4	95.0	93.6
150	94.1	95.8	95.4	93.6	95.0	95.8	95.8	93.6
200	95.0	95.8	95.4	93.6	95.4	96.2	95.8	94.1

2.05 SINGLE-PHASE MOTORS

A. Motors equal to 1/12 HP or greater and less than 1 HP be a minimum 70% efficient and be one of the following, to suit starting torque and requirements of specific motor application. Provide electronically commutated motors (ECM) where indicated on the drawings.

1. Permanent-split capacitor.

2. Split phase.

3. Electrically Commuted (ECM).

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Provide electrically commutated motors shall be provided. Provide with integral variable speed control capable of accepting a variable analogue signal from the Building Automation System.

E. Motors 1/20 HP and Smaller: Shaded-pole type.

F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3: EXECUTION, GENERAL

3.01 INSTALLATION, GENERAL

A. Install motor and equipment associated with the mechanical installation, including items furnished by others.

B. Provide electrical requirements for equipment installation, connection, and control. Refer to Division 26 for exceptions.

3.02 POWER FACTOR CORRECTION

A. Power factor correction shall be installed on all motors ½ horsepower or larger to correct motor power factor to 95 percent or greater. Power factor correction is not required for motors installed with variable speed drives or packaged rooftop or condensing units with multiple motors.

B. If factory mounting is not an equipment option, then provide required correction devices and field install. Field installation shall be done in accordance with manufacturer's guidelines. The costs for field installation shall be included in the mechanical contractors scope of work.

END OF SECTION 23 05 13

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe positioning systems.
7. Equipment supports.

1.02 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."

3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2: PRODUCTS

2.01 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.04 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 INSULATION SHIELD

A. Description: 16 gauge galvanized sheet metal formed to fit contour of pipe insulation.

B. Shield Length: Minimum 12”.

2.06 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.07 FIELD FABRICATED EQUIPMENT AND PIPE SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes. All support components installed outside shall be stainless steel or hot dipped galvanized.

2.08 2.08MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

A. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3: EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.

12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above or below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

b. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold and hot piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers. Provide with continuous vapor barrier.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with same thickness as piping insulation.

3.03 EQUIPMENT AND PIPE SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor or grade.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for [trapeze pipe hangers] [and] [equipment supports].

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to a maximum of 1-1/2 inches. Threaded rods shall be trimmed to be flush with supports in exposed areas at 7'-0" and lower.

3.06 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Valve tags.

1.02 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.03 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch or Stainless steel minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.
3. Color: Provide background and lettering color in accordance with Part 3 applications.

2.03 DUCT LABELS

A. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

B. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

C. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

D. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

E. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

3. Color: Provide background and lettering color in accordance with Part 3 applications.

2.04 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass or Stainless steel minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Provide equipment labels for each piece of equipment identified on drawing schedules.

D. Provide identification at access panels to all fire, smoke, and combination fire smoke dampers.

3.03 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Black.
b. Letter Color: White.

2. Natural Gas Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

3.04 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Supply, Return, and Mixed air:

a. Background Color: Green
b. Letter Color: White

2. Exhaust and Relief Air:

a. Background Color: Red
b. Letter Color: White

3. Outside Air:

a. Background Color: Blue
b. Letter Color: White

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.05 VALVE-TAG INSTALLATION

A. Install tags on main and branch line shut off valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves at equipment; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Refrigerant: 1-1/2 inches, round.
b. Gas: 1-1/2 inches, round.

2. Valve-Tag Color:

    a. Refrigerant: Natural.
    b. Gas: Natural.

3. Letter Color:

    a. Refrigerant: Black.
    b. Gas: Black.

END OF SECTION 23 05 53

SECTION 23 07 00

HVAC INSULATION

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Insulation Materials:

    a. Flexible elastomeric.
    b. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail insulation application at pipe expansion joints for each type of insulation.

3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

4. Detail removable insulation at piping specialties, equipment connections, and access panels.

5. Detail application of field-applied jackets.

6. Detail application at linkages of control devices.

C. Qualification Data: For qualified Installer.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in applying insulation materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance. Installer shall meet, at a minimum, all requirements listed below. Upon request, submit evidence of such qualifications to the Engineer.

1. Company specializing in performing work of this section with minimum three years documented experience, minimum three successfully completed projects of similar scope and complexity, and approved by manufacturer.

2. Designate one individual as project foreman who shall be on site at all times during installation.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency. Insulation shall have a flame-spread index of 25 or less and smoke-developed index of 50 or less.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.05 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.06 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2: PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric (FE): Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials; thermal conductivity (avg) of 0.25 Btu/hr-ft^2-°F or lower at mean temperature of 75°F; 3.0 lbs./ft^3 density (ASTM D1622); 0.08 perm-in permeability (ASTM E96); 0.2% water absorption (ASTM C209).

G. Mineral-Fiber Blanket Insulation (MF): Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I; thermal conductivity (avg) of 0.27 Btu/hr-ft^2-°F or lower at mean temperature of 75°F. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Refer to Part 3 below for insulation density.

H. Rigid Fiberglass Board Ductwork Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type 1, 3.0 lb./cu. ft. density for up to 450°F. Service shall meet or exceed ASTM C 680 thermal conductivity test of .23 BTU-in/hr-ft^2 - °F at 75°F mean temperature. Provide with factory applied FSK jacket.

2.02 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: Minus 20 to plus 200 deg F.

3. Solids Content: 63 percent by volume and 73 percent by weight.

4. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.

2. Service Temperature Range: Minus 50 to plus 180 deg F.

3. Color: White.

2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F.

4. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F.

4. Color: White.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I, for applications where the systems operate below ambient temperature at least part of the time or where a vapor barrier is required.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I, for applications where the systems operate below ambient temperature at least part of the time or where a vapor barrier is required.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II. Vapor retarder shall be rated for 150°F service, ASTM E 96 vapor permeance rated at 0.02 perms., for applications where systems operate above ambient temperatures or where a vapor retarder is not required.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, as follows:

1. Shall comply with ASTM C921, Type I, for applications where the systems operate below ambient temperature at least part of the time or where a vapor barrier is required.

2. Shall comply with ASTM C921, Type II, for applications where systems operate above ambient temperatures or where a vapor retarder is not required.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.

2. Color: White.

3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

C. Fitting Covers:

1. PVC Jacket: One or two piece pre-molded high impact PVC fitting covers with fiberglass inserts and accessories. Covers shall be UV resistant and comply with ASTM 1784-92. Covers shall be sized to comply with insulation applications detailed in Part 3.0.

   a. Below ambient systems: provide continuous vapor barrier in accordance with manufacturer recommendations.

   b. Fiberglass Inserts: Thermal conductivity (ASTM C177), thermal conductivity average of 0.26 Btu/hr-ft^2-˚F or lower at a mean temperature of 75 ˚F.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

   a. Factory cut and rolled to size.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Outdoor Applications: 2.5-mil- thick Polysurlyn.
   d. Factory-Fabricated Fitting Covers:

      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.09 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.

2. Thickness: 6.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500 percent.

5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.

2. Thickness: 3.7 mils.

3. Adhesion: 100 ounces force/inch in width.

4. Elongation: 5 percent.

5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch wide with wing seal.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch wide with wing seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

c. Adhesive-backed base with a peel-off protective cover.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.11 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 PIPING INSULATION APPLICATION

A. Piping System Insulation: Insulate with insulation types and thicknesses as listed in the table below. If more than one pipe material is listed for a piping system, selection from materials listed is the contractor's option.

TABLE NO. 23 07 00: MINIMUM PIPE INSULATION

			Insulation Thickness in Inches for Pipe Sizes				
Piping System Types	**Fluid Temp Range, °F**	**Type of [1] Insulation**	**3/4" and Smaller**	**1" to 1 ¼"**	**1 ½" to 3"**	**4" to 6"**	**8" and Larger**
Condensate Drains	Any	FE	½"	1"	1"	-	-

[1] Insulation material abbreviations:
a. Flexible Elastomeric (FE)
[2] Provide flexible elastomeric cellular insulation at valves and fittings. Refer to drawings for installation details.
[3] Unconditioned spaces shall include all systems indicated located in mechanical rooms, tunnels, boiler rooms, out door storage rooms, and outside the building envelope.

B. Refer to Division 23 Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for insulation insert and insulation shield requirements.

3.04 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return, and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed exhaust air entering and leaving energy recovery ventilators.
4. Indoor, concealed exhaust and relief routed in attic.
5. Indoor, exposed exhaust and relief. Insulate in the conditioned space a minimum of 3'-0" from the building exterior and extending to 3'-0" beyond the isolation damper where a damper is present.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1/IECC.
2. Factory-insulated flexible ducts.

3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.05 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed in Contractor's option. All ductwork and plenums in attics shall be insulated to a minimum of R-12.

1. Concealed supply, return, and outdoor air duct insulation routed in attic:

   a. Mineral-Fiber Blanket: Single layer, 4.2 inches thick and 0.75-lbs/cu.ft. nominal density.
   b. Mineral-Fiber Blanket: Two layers, each 2-inches thick and 1.0-lb/cu.ft, nominal density. Omit vapor barrier on inner layer.

2. Concealed exhaust and relief air duct insulation routed in attic:

   a. Rigid Fiberglass Board: 3 inches thick and 3.0-lb/cu. ft nominal density.

3. Exposed supply air duct insulation:

   a. Rigid Fiberglass Board: 2 inches thick and 3.0-lb/cu. ft nominal density.

4. Exposed outdoor air duct insulation:

   a. Rigid Fiberglass Board: 2 inches thick and 3.0-lb/cu.ft. nominal density.
   b. Mineral-Fiber blanket: 2 inches thick and 1.5 lb/cu.ft nominal density. For round ducts only.

5. Exposed exhaust and relief air duct insulation:

   a. Rigid Fiberglass Board: 3 inches thick and 3.0-lb/cu. ft nominal density.

3.06 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each duct system and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. For all insulation, seal exposed fiberglass including cut pre-formed pipe sections with manufacturer's approved mastic.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.07 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

2. Pipe: Install insulation continuously through floor penetrations.

3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Firestopping."

3.08 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Fiberglass inserts with PVC fitting covers are acceptable. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Fiberglass inserts with PVC fitting covers are acceptable. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

E. Provide 16 gauge galvanized sheet metal insulation shields at all hanger locations. Shields shall be a minimum of 12" in length and formed to fit pipe contour.

3.09 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

    d. Do not overcompress insulation during installation.

    e. Impale insulation over pins and attach speed washers.

    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.

2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

END OF SECTION 23 07 00

SECTION 23 11 23

NATURAL-GAS PIPING

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Grout.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed Space: A space that does not have an opening through its boundary to allow the free passage of air to an occupied space. The opening size and location within the space boundary required for a space to be considered non-concealed is at the discretion of the Engineer and the plumbing inspector. The measure of a space that is defined as non-concealed is that odors from a potential gas leak will be readily detected by a building occupant.

1.03 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

1.04 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.
6. Mechanical sleeve seals.
7. Escutcheons.

B. Welding certificates.

C. Field quality-control reports.

D. Operation and Maintenance Data: For motorized gas valves and pressure regulators to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Products and installation shall comply with the International Fuel Gas Code with State amendments.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.07 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.

1.08 COORDINATION

A. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2: PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

   a. Material Group: 1.1.

   b. End Connections: Threaded or butt welding to match pipe.

   c. Lapped Face: Not permitted underground.

   d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

   e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

B. Galvanized Steel Pipe and Fittings: Conform to ASTM A53/A 53M, Type E or S, Grade A or B, Schedule 40.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

3. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

C. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.

2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

   a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

   b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

D. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.

E. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

2.02 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.

6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.03 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.04 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33, and UL/CSA.

1. CWP Rating: 600 psig.

2. Threaded Ends: Comply with ASME B1.20.1.

3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.

4. Tamperproof Feature: Provide feature to allow for field lockout.

5. Listing: Listed and labeled by UL/CSA and an NRTL acceptable to authorities having jurisdiction for valves 1-inch and smaller.

6. Service Mark: Valves 1-1/4-inches to 2-inches shall have initials "WOG" permanently marked on valve body.

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38, and UL, CSA.

1. CWP Rating: Minimum 125 psig

2. Flanged Ends: Comply with ASME B16.5 for steel flanges.

3. Tamperproof Feature: Provide feature to allow for field lockout.

4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110. UL/CSA listed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.

3. Ball: Chrome-plated bronze.

4. Stem: Bronze; blowout proof.

5. Seats: Reinforced TFE; blowout proof.

6. Packing: Threaded-body packnut design with adjustable-stem packing.

7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

8. CWP Rating: 600 psig.

9. Listing: Valves shall be listed and labeled by UL/CSA and an NRTL acceptable to authorities having jurisdiction.

10. Service: Suitable for natural-gas service with "CWP" indicated on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lee Brass Company.
b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.

3. Plug: Bronze.

4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

5. Operator: Square head or lug type with tamperproof feature where indicated.

6. Pressure Class, CSA: 125 psig.

7. Listing: Valves shall be listed and labeled by UL/CSA an NRTL acceptable to authorities having jurisdiction.

8. Service: Suitable for natural-gas service with "CWP" indicated on valve body.

2.05 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASCO Power Technologies, LP; Division of Emerson.
b. Dungs, Karl, Inc.
c. Eaton Corporation; Controls Div.
d. Eclipse Combustion, Inc.
e. Honeywell International Inc.
f. Johnson Controls.

2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Electrical or Mechanical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASCO Power Technologies, LP; Division of Emerson.
b. Dungs, Karl, Inc.
c. Eclipse Combustion, Inc.
d. Goyen Valve Corp.; Tyco Environmental Systems.
e. Magnatrol Valve Corporation.
f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.06 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.

2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Actaris.
   b. American Meter Company.
   c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   d. Invensys.
   e. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.

3. Springs: Zinc-plated steel; interchangeable.

4. Diaphragm Plate: Zinc-plated steel.

5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

6. Orifice: Aluminum; interchangeable.

7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.

9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.

10. Optional features:

    a. Overpressure Protection Device: Factory mounted on pressure regulator.

    b. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

    c. Maximum Inlet Pressure: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.
   g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.

3. Springs: Zinc-plated steel; interchangeable.

4. Diaphragm Plate: Zinc-plated steel.

5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

6. Orifice: Aluminum; interchangeable.

7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.

9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.

10. Optional Features:

    a. Overpressure Protection Device: Factory mounted on pressure regulator.

    b. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

    c. Maximum Inlet Pressure: 2 psig.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.
    e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.

3. Springs: Zinc-plated steel; interchangeable.

4. Diaphragm Plate: Zinc-plated steel.

5. Seat Disc: Nitrile rubber.

6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.

8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

9. Maximum Inlet Pressure: 2 psig.

2.07 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Minimum Operating-Pressure Rating: 150 psig.

2. Combination fitting of copper alloy and ferrous materials.

3. Insulating materials suitable for natural gas.

4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Minimum Operating-Pressure Rating: 150 psig.

2. Combination fitting of copper alloy and ferrous materials.

3. Insulating materials suitable for natural gas.

4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Minimum Operating-Pressure Rating: 150 psig.

2. Companion-flange assembly for field assembly.

3. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.

4. Insulating materials suitable for natural gas.

5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.08 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

2.09 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.10 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3: EXECUTION

3.01 PIPE APPLICATIONS

A. Within Building: Install Schedule 40 black steel pipe with welded joints for all pipe sizes. Steel pipe with threaded joints or copper pipe with brazed joints, may be installed for 2" and smaller piping where routed in locations not defined as a concealed space.

B. Outside Building (Above Ground):

1. Up to 2": Install galvanized steel pipe with threaded joints and fittings.
2. 2 ½" and Larger: Schedule 40 black steel pipe with welded joints. Paint piping in accordance with all Specification Section 09 91 00 "Painting" requirements. Submit finish color for approval by Architect.

C. Outside Building (Below Grade):

1. PE pipe and fittings joined by heat fusion. Provide tracer wire and terminate in an accessible location.

3.02 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve.

3.03 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.

2. Cut threads full and clean using sharp dies.

3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.

4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.

2. Bevel plain ends of steel pipe.

3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.04 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.05 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to State Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with State Code requirements for prevention of accidental ignition.

3.06 OUTDOOR PIPING INSTALLATION

A. Comply with State Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to coating on pipe as recommended in writing by protective coating manufacturer.

D. Install fittings for changes in direction and branch connections.

E. Install pressure gage downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

F. Install sleeves and mechanical sleeve seals per the requirements of Division 23 Section “Common Work Results for HVAC”.

3.07 INDOOR PIPING INSTALLATION

A. Comply with State Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install escutcheons at penetrations of interior walls, ceilings, and floors. Escutcheons in areas exposed to view shall have a chrome plated finish.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Space: In accordance with the definition in Part 1, the following conditions are considered to be concealed spaces. The following is not intended to be a complete list of all concealed conditions within the building. All piping in a concealed space shall have welded joints and fittings. Mechanical fittings, valves, and unions are not allowed.

1. Above-Ceiling Locations: That are not return plenums or do not have a reasonably sized and located opening to allow free passage of air to the occupied space below.

2. Piping In Partitions: Piping routed in partition walls shall be open to a non-concealed ceiling space and allow the free passage of air for the entire height of the partition.

Q. Prohibited Locations: Do not install gas piping in or through a circulating air duct, clothes chute, chimney or gas vent, ventilating duct, dumb waiter, elevator shafts within poured concrete floors, or below grade within the building perimeter.

R. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

S. Connect branch piping from top or side of horizontal piping.

T. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

U. Do not use natural-gas piping as grounding electrode.

V. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

W. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

X. Install sleeves and mechanical sleeve seals per the requirements of Division 23 Section “Common Work Results for HVAC”.

3.08 SERVICE-METER

A. Coordinate with the local utility for new service meter installation or for required modifications to the existing meter.

3.09 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

C. Install a code approved shut-off valve in the gas main in an accessible location, just inside the building, before the first branch line.

3.10 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal piping with the following minimum rod sizes and maximum spacing for trapeze type hangers with multiple rise runs of varying sizes. The hangers shall be spaced based upon the smallest diameter pipe.

Nom. Pipe Size – Inches	Steel Pipe Max. Span – Ft.	Copper Tube Max. Span – Ft.	Min. Rod Dia. – Inches
½	6	4	3/8
¾	8	6	3/8
1	8	7	3/8
1¼	9	7	3/8
1½	9	8	3/8
2	9	8	3/8
2½	10	9	½
3	10	10	½
3½	10	10	½
4	10	10	½

C. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer’s written instructions.

3.11 CONNECTIONS

A. Install piping adjacent to appliances to allow service and maintenance of appliances.

B. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

C. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.12 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

3.13 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

3.14 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to State Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 23 11 23

SECTION 23 31 13

DUCTWORK

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

1.02 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated. Closure systems shall comply with their applicable UL 181 label and listing.

1. Static-Pressure Classes:

   a. Supply Ducts (non-variable air volume systems): 2-inch.
   b. Return Ducts (Negative Pressure): 1-inch wg.
   c. Exhaust Ducts (Negative Pressure): 1-inch wg.
   d. Outside Air Ducts (Negative Pressure): 2-inch wg.
   e. Relief Ducts (Positive Pressure): 1-inch wg.

2. Refer to “PART 3: EXECUTION” for duct leakage testing requirements based on the static pressure classes listed above.

1.03 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.

11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings: Refer to requirements in Section 23 05 00 “Common Work Results for HVAC.”

D. Welding certificates.

E. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Leakage Tests: Perform tests as directed by the Testing Agent and submit reports.

PART 2: PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for surfaces exposed to View only when shown to be painted on architectural plans: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. Swimming pool areas shall utilize Type 304L or Type 316L stainless steel reinforcement components.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches. Swimming pool areas shall utilize Type 304L or Type 316L stainless steel tie rods.

2.04 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Closure systems shall comply with their applicable UL 181 label and listing.

C. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

D. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.05 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3: EXECUTION

3.01 DUCT APPLICATIONS

A. Fabricate ducts with galvanized sheet steel.

B. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

C. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

3.02 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated or smoke-rated interior partitions and exterior walls, install fire or fire/smoke dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers. Provide firestopping material as required to maintain fire rating and smoke rating. Comply with all firestopping manufacturer’s installation guidelines.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's “Duct Cleanliness for New Construction Guidelines Advanced Cleanliness Level.”

M. Install duct smoke detectors furnished by Division 26.

N. Install control dampers furnished by others. Coordinate the installation with the Section 23 09 00 and 23 09 93 Contractor.

3.03 SEAM, JOINT AND CONNECTIONS SEALING

A. All longitudinal and transverse joints, seams, and connections in metallic and non-metallic ducts shall be constructed as specified in SMACNA *HVAC Duct Construction Standards – Metal and Flexible* and NAIMA *Fibrous Glass Duct Construction Standards.* All joints, longitudinal and transverse seams, and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants, or tapes. Closure systems used to seal ductwork listed and labeled in accordance with UL 181A shall be marked "181A-P" for pressure-sensitive tape, "181A-M" for mastic or "181A-H" for heat-sensitive tape. Closure systems used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181B-C". Closure systems used to seal metal ductwork shall be installed in accordance with the manufacturer's installation instructions. Pressure-sensitive tape shall not be used as primary sealant on ducts, unless it has been certified to comply with UL 181A or UL 181B by a nationally recognized testing laboratory and the tape is used in accordance with certification. Unlisted duct tape is not permitted as a sealant on any duct.

1. Exception: Continuously welded and locking-type longitudinal joints and seams in ducts operating at static pressures less than 2 inches of water column pressure classification shall not require additional closure systems.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

G. Hangers shall not be attached to metal roof deck.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual."

2. Test the following systems:

   a. 25% of all ductwork in pressure classes 2-inch and greater. Refer to Paragraph 1.03.A.1 for pressure class designations.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before insulation application.

5. Conduct tests at static pressures equal to maximum design pressure class of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

6. Leakage Rates shall be a maximum rate as follows:

   a. Round and flat-oval sheetmetal ducts:

      1) 1-inch pressure class 3.0 CFM/100 sq.ft.
      2) 2-inch pressure class 4.8 CFM/100 sq.ft.
      3) 3-inch pressure class 6.2 CFM/100 sq.ft.
      4) 6-inch pressure class 9.7 CFM/100 sq.ft.
      5) 8-inch pressure class 11.6 CFM/100 sq.ft.

   b. Rectangular sheetmetal ducts:

      1) 1-inch pressure class 6.0 CFM/100 sq.ft.
      2) 2-inch pressure class 9.5 CFM/100 sq.ft.
      3) 3-inch pressure class 12.3 CFM/100 sq.ft.
      4) 6-inch pressure class 19.3 CFM/100 sq.ft.
      5) 8-inch pressure class 23.2 CFM/100 sq.ft.

   c. Round flexible ducts:

      1) 1-inch pressure class 6.0 CFM/100 sq.ft.
      2) 2-inch pressure class 9.5 CFM/100 sq.ft.

C. Duct system will be considered defective if it does not pass tests and inspections. Defective duct systems shall be disassembled, reassembled, and sealed as required for compliance with the test requirements. If initial duct leakage tests fail, the Engineer may require, at the expense of the Contractor, additional testing up to 100 percent of all ductwork in all pressure classes.

D. Prepare test and inspection reports.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

1.02 SUBMITTALS

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

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.

b. Manual volume damper installations.

c. Control damper installations.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Source quality-control reports.

E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2: PRODUCTS

2.01 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 2000 fpm.

C. Maximum System Pressure: 2-inch wg.

D. Frame: 0.063-inch- thick extruded aluminum, with welded corners and mounting flange.

E. Blades: Multiple single-piece blades, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.

H. Blade Axles:

1. Material: Aluminum.

2. Diameter: 0.20 inch.

I. Tie Bars and Brackets: Aluminum.

J. Return Spring: Adjustable tension.

K. Bearings: Steel ball or synthetic pivot bushings.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Front of rear screens.
6. 90-degree stops.

M. Sleeve: Minimum 20-gage thickness.

N. Non-motorized gravity backdraft dampers for exhaust and relief air applications shall meet one of the following requirements:

1. Dampers shall have a maximum air leakage rate of 20 cfm/sq.ft. where not less than 24-inches in either dimension when tested at 1.0-inches water gauge in accordance with AMCA 500-D for such purpose.

2. Dampers shall have a maximum air leakage rate of 40 cfm/sq.ft. where less than 24-inches in either dimension when tested at 1.0-inches water gauge in accordance with AMCA 500-D for such purpose.

3. Dampers 8-inches in diameter or smaller shall be spring-loaded and a weather hood at the point of discharge.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating.

2. Suitable for horizontal or vertical applications.

3. Frames:

   a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.

5. Blade Axles: Galvanized steel.

6. Bearings:

   a. Oil-impregnated bronze or Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

B. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.

3. Include elevated platform for insulated duct mounting.

2.04 CONTROL DAMPERS

A. Provide motorized dampers unless otherwise specified to be provided in Section 23 09 00 “Building Automation System.”

B. Low-leakage rating, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat, U or Angle shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8 inches.
2. Parallel- and opposed-blade design.
3. Galvanized steel.
4. 0.064 inch thick.
5. Blade Edging: Closed-cell neoprene edging.

E. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Oil-impregnated bronze or Molded synthetic.

2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

3. Thrust bearings at each end of every blade.

2.05 TURNING VANES

A. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.06 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.

   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.07 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL for fire rated duct systems including kitchen exhaust systems.

B. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.08 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

   1. Minimum Weight: 26 oz./sq. yd..
   2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

E. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

   1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.

   2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.09 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

B. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Coordinate subparagraphs below with Division 23 Section "Metal Ducts." Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Downstream from manual volume dampers, control dampers, turning vanes, and equipment.

2. At each change in direction and at maximum 50-foot spacing.

3. Upstream of turning vanes.

4. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect diffusers to low-pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped with stainless steel tightening band.

N. Connect flexible ducts to metal ducts with stainless steel tightening band.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

Q. Install duct smoke detectors furnished by Division 26.

R. Install control dampers furnished by others. Coordinate the installation with the Section 23 09 00 and 23 09 93 Contractor.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.

3. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

SECTION 23 34 16

AIR HANDLING

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Ceiling-mounted ventilators.

1.02 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.03 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.

2. Size and location of initial access modules for acoustical tile.

3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. 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.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

1.06 COORDINATION

A. Coordinate size and location of structural-steel support members.

PART 2: PRODUCTS

2.01 CEILING-MOUNTING VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ammerman; General Resource Corp.
2. Broan Mfg. Co., Inc.
3. Captive Aire
4. Carnes Company HVAC.
5. Greenheck.
6. Loren Cook Company.
7. NuTone Inc.
8. Penn Ventilation.
9. Twin City Fan

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

1. Isolation: Rubber-in-shear vibration isolators.
2. Manufacturer's standard wall cap and transition fittings.

2.02 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment", including, but not limited to, efficiency ad power factor correction requirements.

B. Enclosure Type: Totally enclosed, fan cooled.

C. Direct-Driven Units: Encase motor in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.

2.03 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3: EXECUTION

3.01 INSTALLATION

A. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

B. Support suspended units from structure using threaded steel rods and elastomeric hangers or spring hangers as specified having a static deflection of 1 inch.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Label fans according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.03 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Adjust damper linkages for proper damper operation.

5. Verify lubrication for bearings and other moving parts.

6. Verify that manual and automatic volume control in connected ductwork systems are in fully open position.

7. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Refer to Division 23 Section "Testing, Adjusting, and Balancing " for testing, adjusting, and balancing procedures.

C. Replace fan and motor pulleys as required to achieve design airflow.

D. Lubricate bearings.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 34 16

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Air diffusers.
2. Registers and grilles.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the manufacturers specified:

1. Anemostat
2. Carnes
3. Krueger
4. Titus
5. Metalaire
6. Nailor
7. Price
8. Tuttle and Bailey

2.02 AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Diffuser Faces:

   a. Round: Round housing, core of concentric rings, round duct connection.
   b. Square: Square housing, core of square concentric louvers, square or round duct connection.
   c. Linear: Extruded aluminum continuous slot, single or multiple.

2. Diffuser Mountings:

   a. Lay-in: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.

   b. Duct-mounted.

3. Diffuser Patterns:

   a. Fixed: Fixed position core with concentric rings or louvers for radial air flow around entire perimeter of diffuser.

   b. Adjustable: Manual adjustable core with concentric rings or louvers, fully adjustable for horizontal to vertical air flow.

4. Diffuser Dampers:

   a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of diffuser.
   b. Integral: Combination volume control and pattern adjustment for linear diffusers.

5. Diffuser Accessories:

   a. Equalizing Deflectors: Adjustable parallel blades in frame for straightening air flow.

   b. Blank-Off Baffles: Arc segments designed to fit into diffuser housing to divert air flow from impinging on obstruction, and to create directional pattern.

   c. Operating Keys: Tools designed to fit through diffuser face and operate volume control device and/or pattern adjustment.

6. Diffuser Finishes:

   a. White Enamel: Semi-gloss white enamel prime finish.

2.03 REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Register and Grille Materials:

   a. Steel Construction (ST): Manufacturer's standard stamped sheet steel frame and adjustable blades.

2. Register and Grille Faces:

   a. Horizontal Straight Blades: Horizontal blades, individually adjustable, at manufacturer's standard spacing.

   b. Vertical Straight Blades: Vertical blades, individually adjustable, at manufacturer's standard spacing.

   c. Horizontal 45^{o} Fixed Blades: Horizontal blades, fixed at 45^{o}, at manufacturer's standard spacing.

3. Register and Grille Patterns:

   a. Single Deflection: 1 set of blades in face.

   b. Double Deflection: 2 sets of blades in face, rear set at 90^{o} to face set.

4. Register and Grille Dampers:

   a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of register.

5. Register and Grille Accessories:

   a. Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.

6. Register and Grille Finishes:

   a. White Enamel: Semi-gloss white enamel prime finish.

2.04 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, “Method of Testing for Rating the Performance of Air Outlets and Inlets.”

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.02 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 37 23

HVAC GRAVITY VENTILATORS

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following types of roof-mounting intake and relief ventilators:

1. Roof hoods.

1.02 SUBMITTALS

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

B. Shop Drawings: For intake ventilators. Include plans, elevations, sections, details, and ventilator attachments to curbs and curb attachments to roof structure.

C. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which roof curbs and ventilators will be attached.
2. Sizes and locations of roof openings.

D. Samples for Verification: For each type of exposed finish required for intake and relief ventilators.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain ventilators through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of intake and relief ventilators and are based on the specific equipment indicated. Refer to Division 01 Section "Substitutions and Product Options."

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.

1.04 COORDINATION

A. Coordinate installation of roof curbs and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.

E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

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

2.03 FABRICATION, GENERAL

A. Factory or shop fabricate intake and relief ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.04 ROOF HOODS

F. Manufacturers:

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan company.
3. Carnes.
4. Greenheck.
5. Loren Cook Company.
6. Penn Ventilation.

G. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.

H. Materials: Galvanized-steel sheet, minimum 0.064-inch-thick base and 0.040-inch-thick hood; suitably reinforced.

I. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with or built-in raised cant and mounting flange as required for roofing installation.

2. Height: 24 inches. Refer to installation detail.

J. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire.

K. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

2. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install intake and relief ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install intake and relief ventilators with clearances for service and maintenance.

C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.

E. Label intake and relief ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.02 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

3.03 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 23 37 23

SECTION 23 54 00

FURNACES

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Gas-fired, noncondensing furnaces and accessories complete with controls.
2. Air filters.
3. Energy Recovery Ventilators.
4. Refrigeration components.

1.02 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:

1. Furnace.
2. Thermostat.
3. Air filter.
4. Energy Recovery Ventilators.
5. Refrigeration components.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals for each of the following:

1. Furnace and accessories complete with controls.
2. Air filter.
3. Energy Recovery Ventilators.
4. Refrigeration components.

D. Warranty: Special warranty specified in this Section.

1.03 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

1.04 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:

a. Furnace Heat Exchanger: 10 years
b. Integrated Ignition and Blower Control Circuit Board : Five years
c. Refrigeration Compressors: 10 years
d. Evaporator and Condenser Coils: Five years

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Disposable Air Filters: Furnish two complete sets.

PART 2: PRODUCTS

2.01 GAS-FIRED FURNACES, NONCONDENSING

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Adams Manufacturing Company.
2. Amana Heating & Air Conditioning; Goodman Manufacturing Company, L.P.
3. American Standard Companies, Inc.
4. Arcoaire Air Conditioning & Heating; a division of International Comfort Products, LLC.
5. Armstrong Air Conditioning Inc.
6. Bard Manufacturing Company.
7. Bryant Heating & Cooling Systems; Div. of United Technologies Corp.
8. Carrier Corporation; Div. of United Technologies Corp.
9. Clare Brothers.
10. Comfort-Aire; a division of Heat Controller, Inc.
11. Comfortmaker Air Conditioning & Heating; a division of International Comfort Products, LLC.
12. Dornback Furnace.
13. Goodman Manufacturing Company, L.P.
14. Heil Heating & Cooling Products; a division of International Comfort Products, LLC.
15. Lennox Industries Inc.
16. Luxaire Corporation; a division of Unitary Products Group.
17. Rheem Manufacturing Company; Air Conditioning Division.
18. Ruud Air Conditioning Division.
19. Tempstar Heating & Cooling Products; a division of International Comfort Products, LLC.
20. Thermo Products, Inc.; a division of Burnham Holdings Inc.
21. Trane.
22. York International Corp.; a division of Unitary Products Group.

B. General Requirements for Gas-Fired, Noncondensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.

C. Cabinet: Steel

1. Cabinet interior around heat exchanger shall be factory-installed insulation.

2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.

D. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

1. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment.
2. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

E. Type of Gas: Natural.

F. AFUE: 80 percent.

G. Heat Exchanger: Aluminized steel.

H. Burner:

1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

I. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

J. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

K. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; and adjustable fan-on and fan-off timing; terminals for connection to accessories.

L. Capacities and Characteristics:

1. Airflow Configuration: Upflow

2. Gas:

a. Type: Natural.
b. Venting Type: Power venter with combustion-air intake.

2.02 THERMOSTATS

A. Solid-State Thermostat: Wall-mounting, programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, vacation mode, and battery backup protection against power failure for program settings.

B. Control Wiring: Unshielded twisted-pair cabling.

1. No. 24 AWG, 100 ohm, four pair.

2.03 AIR FILTERS

A. Disposable Filters: 1-inch-disposable, fiberglass type in sheet metal frame.

2.04 ENERGY RECOVERY VENTILATOR

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Mitsubishi Electric Sales Canada Inc.
2. RenewAire LLC.

B. Casing: Galvanized steel, with factory-installed interior insulation and manufacturer's standard factory finish. Fabricate with space for piping and electrical conduits.

C. Plates: Heat and humidity transfer, fixed plate, evenly spaced and sealed and arranged for counter airflow.

1. Plate Material: Chemically treated paper with selective hydroscopicity and moisture permeability, and gas barrier properties.

D. Disposable Panel Filters:

1. Comply with NFPA 90A.

2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

3. Provide filters in galvanized-steel frames, mounted upstream of unit in both supply and exhaust airstreams with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.

4. Factory-fabricated, viscous-coated, flat-panel type.

5. Thickness: 1 inch.

6. Arrestance (ASHRAE 52.1): 80.

7. Rating: Merv 8.

8. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.

9. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

E. Supply and Exhaust Fans: Forward curved centrifugal with direct drive. Motors comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

F. Wiring: Wire motors and controls so only external connections are required during installation.

G. Controls: Energy Recovery Ventilators to be controlled by associated furnace. Provide percentage timer control with furnace interlock (FM).

2.05 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with HCFC-free refrigerants.

2. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
3. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Standard for Buildings except Low-Rise Residential Buildings."

B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet.

1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 3/8 inch thick.

D. Refrigerant Piping: Comply with requirements in Division 23 Section "Refrigerant Piping."

E. Air-Cooled, Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed scroll type.

a. Crankcase heater.
b. Vibration isolation mounts for compressor.
c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
e. Refrigerant Charge: R-410A.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

4. Heat-Pump Components: Reversing valve and low-temperature air cut-off thermostat.

5. Fan: Aluminum-propeller type, directly connected to motor.

6. Motor: Permanently lubricated, with integral thermal-overload protection.

7. Low Ambient Kit: Permits operation down to 45 deg F.

8. Mounting Base: Polyethylene.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.

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

3.02 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

1. Install seismic restraints to limit movement of furnace by resisting code-required seismic acceleration.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

1. Anchor furnace to substrate to resist code-required seismic acceleration.

D. Controls: Install thermostats and humidistats at mounting height of 60 inches above floor.

E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

F. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

G. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

3.03 CONNECTIONS

A. Gas piping installation requirements are specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent Connection: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

    a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
    c. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

4. Slope pipe vent back to furnace or to outside terminal.

D. Connect ducts to furnace with flexible connector. Comply with requirements in Division 23 Section " Air Duct Accessories."

E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.

1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."

2. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Comply with requirements in Division 23 Section "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.05 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casings.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

C. Measure and record airflows.

D. Verify proper operation of capacity control device.

E. After startup and performance test, lubricate bearings.

3.06 ADJUSTING

A. Adjust initial temperature set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.07 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 54 00

SECTION 23 82 33

HEATING TERMINAL UNITS

PART 1: GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Cabinet heaters.

1.02 QUALITY ASSURANCE

A. Codes and Standards:

1. I=B=R Compliance: Test and rate baseboard and finned tube radiation in accordance with I=B=R, provide published ratings bearing emblem of I=B=R.

2. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced-Circulation Air-Cooling and Air-Heating Coils".

3. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils".

4. ARI Compliance: Test and rate fan-coil units in accordance with ARI Standard 440 "Room Fan-Coil Air-Conditioners".

5. UL Compliance: Construct and install fan-coil units in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units.

6. ARI Compliance: Test and rate unit ventilators in accordance with ARI Standard 330 "Unit Ventilators".

7. UL Compliance: Provide electrical components for terminal units, which have been listed and labeled by UL.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.

C. Wiring Diagrams submit manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals in accordance with requirements of Division 1.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.

B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

D. Deliver terminal units to job site tagged with label indicating project name, model number, unit number, and details of installation (i.e. room number orientation, etc.).

PART 2: PRODUCTS

2.01 CABINET HEATERS

A. Manufacturer: Subject to compliance with requirements, provide cabinet heaters of one of the following:

1. Reznor
2. Airtherm Mfg. Co.
3. Dunham-Bush, Inc.
4. McQuay, Inc.
5. Trane (The) Co.
6. Young Radiator Co.
7. Vulcan Radiator Corp.
8. Modine Mfgr. Co.
9. Sterling Radiator Co.
10. Rittling
11. Sigma Corporation.

B. General: Provide cabinet heaters having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fanboard, fan wheels, housings, motor, motor starter switch and insulation.

C. Coil Section Insulation: Comply with NFPA 90A or NFPA 90B. Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C 534, Type II, except for density.

1. Thickness: 3/4 inch.

2. Thermal Conductivity (k-Value): 0.24 Btu x in./h x sq. ft. at 75 deg F mean temperature.

3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.

4. Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

D. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect, baked-enamel finish with manufacturer's custom paint, in color selected by Architect.

1. Vertical Unit, Exposed Front Panels: Minimum 0.0528-inch- thick, sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.

2. Recessing Flanges: Steel, finished to match cabinet.

3. Control Access Door: Key operated.

4. Base: Minimum 0.0528-inch- thick steel, finished to match cabinet, 6 inches high with leveling bolts.

E. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.

F. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

G. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.

2. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.02 MOTORS

A. Comply with requirements in Division 23 Section “Common Motor Requirements for HVAC Equipment”, including, but not limited to, efficiency and power factor correction requirements.

1. Permanently lubricated, multi-speed, resiliently mounted. For cabinet unit heaters, connect motor to chassis wiring with plug connection.

PART 3: EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF CABINET HEATERS

A. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Locate cabinet heaters as indicated, coordinate with other trades to assure correct recess size for recessed units.

C. Install units plumb and level.

D. Protect units with protective covers during balance of construction.

3.03 ELECTRICAL WIRING

A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electric Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.04 ADJUSTING AND CLEANING

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filter units for terminals requiring it.

3.05 DEMONSTRATION AND TRAINING

A. Provide demonstration and training for Owner’s representative in accordance with Division 1 Section "Demonstration and Training."

END OF SECTION 23 82 33

SECTION 23 90 00

TESTING, ADJUSTING, AND BALANCING

PART 1: GENERAL

1.01 SUMMARY

A. The testing, adjusting, and balancing contractor shall be hired by the mechanical contractor for the work scope as defined under this specification section.

B. This Section specifies the requirements and procedures for mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, recording and reporting the results.

C. Test, adjust, and balance the following mechanical systems:

1. Supply air systems.
2. Return air systems.
3. Exhaust air systems.
4. Domestic hot water recirculation loop.

D. Test systems for proper sound and vibration levels.

E. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes;

2. Specifications for materials for patching mechanical systems;

3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.02 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. the balance of air and water distribution;
2. adjustment of total system to provide design quantities;
3. electrical measurement;
4. sound and vibration measurement.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

L. Construction Tests: Tests specified in other sections. Includes leak testing of piping and duct systems.

1.03 SUBMITTALS

A. Agency Data:

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data:

1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and Section 23 05 00.

E. Test and Balance Reports:

1. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC, NEBB, TABB are proposed.

2. Sample Forms: Submit sample forms, if other than those standard forms prepared by the NEBB are proposed.

3. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

a. Preliminary Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports shall be submitted prior to Substantial Completion and include at a minimum documentation of required ventilation airflows and preliminary balancing of all primary supply air equipment including central air handlers, rooftop units, fan coil units and unit ventilators. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

b. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.

c. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

1) General Information and Summary
2) Air Systems
3) Temperature Control Systems
4) Special Systems
5) Sound and Vibration Systems
6) Domestic Hot Water Recirculation Loop

d. Report Contents: Provide the following minimum information, forms and data:

1) General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

2) The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

4. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.04 QUALITY ASSURANCE

A. Test and Balance Engineer's Qualifications: The on-site test and balance technician shall be NEBB or TABB or AABCcertified, be in the employ of the Test and Balance agency and have at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications: The testing, adjusting and balancing technicians and supervisor staffed to perform work on site shall be certified by the National Environmental Balancing Bureau (NEBB) or TABB or AABC in the following disciplines:

1. Testing, adjusting, and balancing.

a. Air

C. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".
2. ASHRAE: ASHRAE Handbook, HVAC Applications. Testing, Adjusting, and Balancing.

D. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect and representatives of installers of the mechanical systems, and the Owner’s commissioning agent. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.05 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate all onsite inspections with the prime contractor.

B. Develop detailed work plan with the prime contractor, HVAC subcontractors, and Building Automation System contractor such that testing work will proceed in areas as systems are started and available.

1.07 SUBMITTALS

A. The Balancer shall coordinate with the Mechanical Contractor to receive all submittals for air handling and hydronic equipment prior to starting balancing. Balancing shall be completed based on final submittal information.

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.
12. Check fan rotation.

3.02 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all readings with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.03 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

H. Air system balancing shall provide airflow rates within ± 10 percent of design capacities and fan speed shall be adjusted to meet design airflow conditions.

3.04 TESTING FOR SOUND AND VIBRATION

A. Testing, adjusting, and balancing work shall include an allowance of 16 hours to perform sound and vibration testing at the direction of the Engineer. The goal of the testing will be to identify corrective work such that all areas perform within the design sound levels. All teaching and office areas are designed for a sound level of NC 35 or less. Sound testing shall be conducted in accordance with the referenced standards.

3.05 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

C. Include an allowance of 8 hours per building location to provide re-testing and re-balancing at the direction of the architect/engineer. The goal of this re-testing and re-balancing will be to verify the performance of any corrective work and to help assure that all areas perform within the design range set for air and water flow rates.

3.06 DEMONSTRATION AND TRAINING

A. Training:

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures (minimum of 8 hours) in accordance with the requirements of specification section 01 79 00, “Demonstration and Training.”

2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

END OF SECTION 23 90 00

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Section Includes:

1. Copper building wire rated 600 V or less.
2. Fire-alarm wire and cable.
3. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

PART 2: PRODUCTS

2.01 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.02 FIRE-ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair**,** not less than size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

2.03 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with standard barrels.
3. Termination: Compression.

PART 3: EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders, branch circuits: Copper; stranded.

B. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance, Feeders and Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.04 INSTALLATION OF FIRE-ALARM WIRING

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway except where mounted above concealed accessible ceilings and above 10 feet where ceiling is exposed.

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.05 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

D. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.06 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.07 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.08 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.

b. Test bolted connections for high resistance using one of the following:

1) A low-resistance ohmmeter.
2) Calibrated torque wrench.
3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.
d. Inspect for correct identification.
e. Inspect cable jacket and condition.
f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

PART 2: PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.03 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

K. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

N. Straps: Solid copper, copper lugs. Rated for 600 A.

O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

P. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.

    a. Material: Tin-plated aluminum.
    b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.04 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3: EXECUTION

3.01 APPLICATIONS

A. Conductors: Install stranded conductors.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Use exothermic welds for all below-grade connections.
3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

J. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Galvanized steel.
3. Channel Width: Selected for applicable load criteria.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M,Grade A325.
6. Toggle Bolts: Stainless-steel springhead type.
7. Hanger Rods: Threaded steel.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3: EXECUTION

3.01 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.

1.03 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

PART 2: PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. IMC: Comply with ANSI C80.6 and UL 1242.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. FMC: Comply with UL 1; zinc-coated steel or aluminum.
6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: Setscrew or compression.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

C. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fiberglass:

    a. Comply with NEMA TC 14.
    b. Comply with UL 2515 for aboveground raceways.
    c. Comply with UL 2420 for belowground raceways.

3. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

B. Nonmetallic Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

I. Gangable boxes are prohibited.

PART 3: EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: IMC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Gymnasiums.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

3.02 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC to GRC or IMC before rising above floor.

M. Stub-Ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

U. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

CC. Locate boxes so that cover or plate will not span different building finishes.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install 0sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.06 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2: PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

    a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.02 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

1. Color shall be factory applied.

2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

4. Color for Neutral: White.
5. Color for Equipment Grounds: Green.

C. Equipment Identification Labels:

1. Black letters on a white field.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

    a. 1-1/2 by 6 inches for raceway and conductors
    b. 3-1/2 by 5 inches for equipment.
    c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.05 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.

D. Underground-Line Warning Tape:

1. Tape:

   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

   a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.06 TAGS

A. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

2.07 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

   a. For signs up to 20 sq. in., minimum 1/16 inch thick.
   b. For signs larger than 20 sq. in., 1/8 inch thick.
   c. Engraved legend with black letters on white face
   d. Self-adhesive.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.08 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3: EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."
4. “PANEL NAME”
5. “CIRCUITS”

L. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

V. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

W. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using plenum-rated cable ties.

X. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

Y. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.03 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- high, black letters on 20-inch centers.

1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-foot maximum intervals.

D. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive labels

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."
4. “PANEL NAME”
5. “CIRCUITS”

G. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

H. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

I. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

J. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

K. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

L. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

M. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

N. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

O. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

P. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

Q. Arc Flash Warning Labeling: Self-adhesive labels.

R. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    g. Substations.
    h. Emergency system boxes and enclosures.
    i. Motor-control centers.
    j. Enclosed switches.
    k. Enclosed circuit breakers.
    l. Enclosed controllers.
    m. Variable-speed controllers.
    n. Push-button stations.
    o. Power-transfer equipment.
    p. Contactors.
    q. Remote-controlled switches, dimmer modules, and control devices.
    r. Battery-inverter units.
    s. Battery racks.
    t. Power-generating units.
    u. Monitoring and control equipment.
    v. UPS equipment.

END OF SECTION 26 05 53

SECTION 26 05 73.13
SHORT-CIRCUIT STUDIES

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

1. Computer-based, fault-current study to determine minimum interrupting capacity of circuit protective devices.

B. Related Requirements:

1. Section 260573.16 "Coordination Studies" for overcurrent protective device coordination studies.
2. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash studies.

1.02 DEFINITIONS

A. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

C. SCCR: Short-circuit current rating.

D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

E. Single-Line Diagram: See "One-Line Diagram."

1.03 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Short-Circuit Study Report:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form.

    a. Short-circuit study input data, including completed computer program input data sheets.
    b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
    c. Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.05 QUALITY ASSURANCE

A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

PART 2: PRODUCTS

2.01 POWER SYSTEM ANALYSIS SOFTWARE

A. SKM

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of power systems analysis software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program must be capable of plotting and diagramming time-current-characteristic curves as part of its output.

E. Computer program must be designed to perform short-circuit studies or have function, component, or add-on module designed to perform short-circuit studies.

F. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by study.

D. Comments and recommendations for system improvements or revisions in written document, separate from one-line diagram.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600 V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Calculated asymmetrical fault currents:

        1) Based on fault-point X/R ratio.
        2) Based on calculated symmetrical value multiplied by 1.6.
        3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.
    e. Equivalent impedance.
    f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
    g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

PART 3: EXECUTION

3.01 POWER SYSTEM DATA

A. Obtain data necessary for conduct of study.

1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

B. Gather and tabulate required input data to support short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to amount of detail that is required to be acquired in field. Field data gathering must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.

5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.02 SHORT-CIRCUIT STUDY

A. Perform study following general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 5 kA or less.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.

I. Include in report identification of protective device applied outside its capacity.

END OF SECTION 260573.13

SECTION 26 24 16
PANELBOARDS

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. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.

B. All panelboards and associated overcurrent protection devices shall be rated to meet the requirements of the fault current study. The electrical contractor is responsible to provide the overcurrent protection devices required for a complete selective coordinated system. Both shall be provided at no additional cost to the project.

1.03 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Operation and Maintenance Data: For panelboards and components 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. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories 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 PB 1.

D. Comply with NFPA 70 and all local ordinances.

1.05 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface mounted cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.

4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches> high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
4. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
5. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings (provide as required for a coordinated system):

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.

6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. All circuit breakers shall be rated and be of a type as required by the fault current and selective coordination study, at no additional cost to the project.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

B. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Snap switches and wall-box dimmers.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. 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.

C. Comply with NFPA 70 and local ordinances.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.04 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

2.05 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations" when the outlet is in use.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant (when receptacle is plugged in), die-cast aluminum with lockable cover.

2.06 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1: GENERAL

1.01 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.

1.02 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70 and local ordinances.

1.06 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2: PRODUCTS

2.01 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

2.02 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate See Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 28 16

SECTION 263213.16
GAS-ENGINE-DRIVEN GENERATOR SETS

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. Section Includes:

1. Engine.
2. Gas fuel system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Outdoor generator-set enclosure.
7. Vibration isolation devices.

B. Related Requirements:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.03 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in cubic feet per hour (cubic meters per hour) at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95 deg F Provide drawings showing requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.

4. Design calculations for selecting vibration isolators.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.05 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions showing compliance with applicable regulations.

B. Field quality-control reports.

C. Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
b. Operating instructions laminated and mounted adjacent to generator location.
c. Training plan.

1.07 QUALITY ASSURANCE

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

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers

1. Kohler
2. Generac
3. Cummins-Onan

B. Source Limitations: Obtain packaged engine generators and auxiliary components through one source from a single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 1 EPSS.

B. Engine Exhaust Emissions: Comply with EPA requirements and applicable state and local government requirements.

C. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: -15 to 104 deg F
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet.

2.03 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and use.

C. Power Rating: Standby.

D. Power Factor: 0.8, lagging.

E. Frequency: 60 Hz.

F. Voltage: 240 V ac.

G. Phase: Single-phase, three wire.

H. Governor: Adjustable isochronous, with speed sensing.

I. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

J. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

K. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.

6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time:
    a. Comply with NFPA 110, Type 10 system requirements.
    b. 10 seconds.

2.04 GAS ENGINE

A. Fuel: Natural gas.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499.

E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer:

1. Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 12-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
1. Cranking Cycle: 60 seconds.

2. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
3. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
4. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
5. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1.

2.05 GAS FUEL SYSTEM

A. Natural Gas Piping: Comply with requirements in Section 231123 "Facility Natural Gas Piping."

B. Gas Train: Comply with NFPA 37.

C. Engine Fuel System:

D. Natural Gas, Vapor-Withdrawal System:

1. Carburetor.
2. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
3. Fuel Filters: One for each fuel type.
4. Manual Fuel Shutoff Valves: One for each fuel type.
5. Flexible Fuel Connectors: Minimum one for each fuel connection.

2.06 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates generator-set shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates generator-set shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine generator battery.
2. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel. Panel shall be powered from the engine generator battery.
3. Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel shall be powered from the engine generator battery. Panel features shall include the following:

F. Control and Monitoring Panel:

1. Digital controller with integrated LCD, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gage.
    b. Engine-coolant temperature gage.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, connected to a phase selector switch.
    f. AC ammeter, connected to a phase selector switch.
    g. AC frequency meter.
    h. Generator-voltage adjusting rheostat.

3. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low water temperature alarm.
    g. High engine temperature prealarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Coolant low-level alarm.
    m. Coolant low-level shutdown device.
    n. Coolant high-temperature prealarm.
    o. Coolant high-temperature alarm.
    p. Coolant low-temperature alarm.
    q. Coolant high-temperature shutdown device.
    r. EPS supplying load indicator.
    s. Battery high-voltage alarm.
    t. Low cranking voltage alarm.

u. Battery-charger malfunction alarm.
v. Battery low-voltage alarm.
w. Lamp test.
x. Contacts for local and remote common alarm.
y. Generator overcurrent protective device not closed alarm.

G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:

1. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:

a. Tripping Characteristic: Designed specifically for generator protection.
b. Trip Rating: Matched to generator output rating.
c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
d. Mounting: Adjacent to or integrated with control and monitoring panel.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six lead alternator.

E. Range: Provide limited range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 15 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Subtransient Reactance: 12 percent, maximum.

2.09 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description:

1. Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 100 mph.

C. Hinged Doors: With padlocking provisions.

D. Muffler Location: Within enclosure.

E. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2.10 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum Deflection: 1 inch.

B. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115 and with NFPA 110, Level 1 Energy Converters.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

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

3.02 INSTALLATION

A. Comply with packaged engine generator manufacturers' written installation and alignment instructions.

B. Equipment Mounting:

1. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inchon steel frame provided by others. Coordinate mounting points and mounting method with streel installer.

C. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Gaseous Fuel Piping:

1. Natural gas piping, valves, and specialties for gas distribution are specified in Section 231123 "Facility Natural Gas Piping."

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel piping adjacent to packaged engine generator to allow service and maintenance.

C. Gaseous Fuel Connections:

1. Connect fuel piping to engines with a gate valve and union and flexible connector.
2. Install manual shutoff valve in a remote location to isolate gaseous fuel supply to the generator.
3. Vent gas pressure regulators outside building a minimum of 60 inches from building openings.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

F. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.04 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs below as specified in the NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with drawings and specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Perform insulation-resistance tests in accordance with IEEE 43.

            a) Machines larger than 200 hp. Test duration shall be 10 minutes. Calculate polarization index.
            b) Machines 200 hp or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.

        2) Test protective relay devices.
        3) Verify phase rotation, phasing, and synchronized operation as required by the application.
        4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
        5) Verify correct functioning of the governor and regulator.

2. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.

d. Verify that measurements are within manufacturer's specifications.

3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
5. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
6. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

B. Coordinate tests with tests for transfer switches and run them concurrently.

C. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

D. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

G. Remove and replace malfunctioning units and retest as specified above.

H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

I. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.06 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 24 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

3.07 DEMONSTRATION

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

END OF SECTION 263213.16

SECTION 26 36 00
TRANSFER SWITCHES

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Transfer Switches

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.
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. Comply with NEMA ICS 1.
E. Comply with NFPA 70 and all local ordinances.
F. Comply with NFPA 99.
G. Comply with NFPA 110.
H. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Caterpillar; Engine Div.
b. Emerson; ASCO Power Technologies, LP.
c. Generac Power Systems, Inc.
d. GE Zenith Controls.
e. Kohler Power Systems; Generator Division.
f. Onan/Cummins Power Generation; Industrial Business Group.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

I. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.03 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

G. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.04 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3: EXECUTION

3.01 INSTALLATION

A. Identify components according to Section 260553 "Identification for Electrical Systems."
B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.02 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate tests with tests of generator and run them concurrently.
D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
E. Remove and replace malfunctioning units and retest as specified above.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."
B. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

SECTION 26 41 13
LIGHTING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 DESCRIPTION

A. General: Provide a complete extension of the existing lightning protection system as indicated on the drawings and as specified herein. The lightning protection system shall be installed by a firm presently engaged in installations of Master Labeled or LPI certified lightning protection systems. The system as completed shall comply with the latest edition of UL96A, Installation Requirements for Lightning Protection Systems, and NFPA-780 "Standard for the Installation of Lightning Protection Systems." The system shall meet all requirements of these standards and the Lightning Protection Institute Standard of Practice LPI-175. All components required for a UL master label and a full LPI certification plate shall be provided whether or not such materials are specifically addressed by the contract drawings or described herein.

B. Qualification: All installers shall be experienced with installing UL master labeled and LPI certified systems or of equivalent qualification, as accepted in writing by the engineer of record. A UL/LPI certified installer shall be on the project site at all times during installation of the systems and shall supervise all of the installation.

1.3 COUNTERPOISE CONDUCTOR

A. General: The structure shall be provided with a below-grade continuous counterpoise conductor, equal in size to the largest conductor in the building lightning protection system, or sized as indicated on the drawing. This conductor shall be installed at a minimum depth of two feet below finished grade and a minimum of two feet from the exterior foundation wall of the building. The counterpoise conductor shall be copper and extend continuously around the entire perimeter of the building. All joints and connections shall be exothermically welded.

B. Counterpoise: As a minimum, the counterpoise conductor shall be connected to each of the following system components utilizing appropriate exothermic welds:

1. Each down conductor.
2. All counterpoise conductors on power and communications ducts which enter the building.
3. The building electrical service ground.
4. All metallic water and gas services entering the building (ahead of meter).
5. All metallic fence posts, safety railings, etc., or any other metallic item within ten feet of the project building.

1.4 SUBMITTALS

A. General: Shop drawings identifying all system wiring and component placement, including all details, shall be submitted to the Engineer for review. The Contractor shall not perform any portion of the Work until the respective submittal has been accepted. All work shall be in accordance with accepted submittals.

B. Detail Submission: Details shall be submitted to the Engineer for review indicating the method of cabling connections and attachments starting at the top of the project building to the ground rods at the counterpoise. All details shall be appropriate for the project.

C. Identification: All product data sheets submitted, for proposed system components, shall clearly identify the item being submitted and shall indicate the UL label.

D. Suppression Device: All transient voltage surge suppressors for the project shall be submitted at the same time as the lightning protection floor plans, details and product data sheets are submitted. Each suppressor shall clearly indicate the item to be protected and shall comply with Section 26 43 13 of these specifications. Suppressors shall be provided as required in NFPA 780 unless otherwise indicated on the drawings or otherwise specified.

E. Deviations: The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the acceptance of shop drawings, product data, samples or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal and the Engineer has given written acceptance to the specific deviation.

F. Certification: Provide documentation of UL master label, LPI certification or equivalent qualification of exact installer intended to do this particular job.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Labels: All materials used for the system installation shall comply in size, composition and weight to all requirements of NFPA U.L. and LPI for the class of system in which they are installed. All materials shall be labeled or listed by Underwriters Laboratories, Inc. for use in master labeled or LPI certified lightning protection systems.

B. Material: Generally, the external lightning protection system at the roof level shall be constructed of aluminum cable and aluminum compatible components. The internal lightning protection system, starting with the down conductors and concluding at the ground termination system (counterpoise and dissipation points) shall be constructed of copper cable and copper compatible components. Likewise, all bonding conductors, equipotential loop conductors, etc, shall also be constructed of compatible cable and components.

C. Compatibility: All portions of the system, whether copper or aluminum, shall be galvanically compatible to the building material to which they are to be attached. Connections between copper and aluminum portions of the system shall be made with appropriate bimetallic coupling devices. In all areas, the conductor shall be supported to maintain clearance from all galvanically incompatible materials or shall be of the same material if permitted within these specifications.

D. Components: All system components (i.e. air terminals, bases, connectors, cable, thru-roof fittings, ground rods, etc.) shall be, to the maximum extent possible, the product of a single manufacturer. All components shall be Class I or II as required by NFPA 780 or as noted. All air terminal bases shall be securely mounted to the building structure by means of adhesive or fasteners. Adhesive type air terminal bases are acceptable only where hard setting epoxy adhesive is utilized, where mechanical fastening is prohibited by the roofing manufacturer and where acceptable to the code authority having jurisdiction. Submit shop drawings for all proposed air terminal mounting details.

2.2 AIR TERMINALS

A. General: Air Terminals shall be solid aluminum as required to match the building system to which they attach. Air terminals shall protrude a minimum of 10 inches above the object to be protected. Center roof terminals shall be 24" high. Air terminal points shall be blunt with the radius of curvature equal to the rod diameter.

B. Base: Each air terminal shall be equipped with the correct type of base for the location in which it is mounted.

C. Roof Top Equipment: Air terminals and interconnecting cable shall be provided for all roof mounted equipment (fans, A/C equipment, etc.) subject to a direct strike as required by NFPA 780 and as shown. Unless specifically noted, use of equipment housing in lieu of interconnecting cables is strictly prohibited. Provide sufficient length at all equipment mounted terminals to allow removal of the terminal without requiring removal/disconnect of the conductor.

2.3 CONDUCTORS

A. General: Main roof conductors shall be aluminum unless otherwise specified or required and shall provide a two-way path from each air terminal horizontally or downward to connections with down conductors. Conductors shall be free of excessive splices and bends. No bend of a conductor shall form an included angle of less than 90 degrees nor have a radius of bend of less than 8 inches. Conductors shall be secured to the structure at intervals not exceeding 3 feet with approved fasteners. Cables connected to "thru-roof" connectors may rise from the roof to the connector at a maximum slope of 3 inches per foot, not exceeding 3 feet horizontally in air.

B. Down Conductors: Down conductors shall be copper and shall be concealed in the exterior wall construction or structural columns. Where run in or on reinforced concrete columns, bond down conductor to the re-bar at top and bottom of column. Where "bottom of column" occurs below the installed counterpoise elevation (-2'-0' BFG), bond to column steel reinforcement at same elevation that down conductor exits column to bond counterpoise conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. Connections to the steel frame shall be made with heavy duty bonding plates having 8 square inches of contact surface or with exothermic welds.

C. Shop Drawing: Submit all conductor types in shop drawings. Each conductor shall be identified as to location in the lightning protection system.

2.4 ROOF PENETRATIONS

A. General: Roof penetrations required for down conductors or for connections to structural steel framework shall be made using pre-manufactured U.L. approved thru-roof type assemblies with solid rods, PVC sleeves and appropriate roof flashing. Roof flashing shall be compatible with the roofing system and shall be provided under this contract and installed by the roofing contractor. Submit roof flashing data sheets and letter of acceptance from roofing contractor in shop drawing package.

2.5 COMMON GROUNDING

A. General: Common grounding of all ground mediums within the project building shall be made by interconnecting with main size conductors, fittings as required or exothermic welds.

B. Bonding: Grounded metal bodies located within the required bonding distance (as determined by the bonding distance formulas in NFPA 780) shall be bonded to the system using bonding conductors and fittings. Bond to rebar utilizing exothermic weld connections.

2.6 GROUND TERMINATIONS

A. General: Two ground terminations shall be provided for each down conductor and shall consist of two 5/8 inch x 10 feet copper-clad ground rods with a 10 to 15 foot separation. Each down conductor shall be connected to the ground rods by an exothermic weld connection. Tops of ground rods shall be located 2 feet below finished grade and 2 feet from the foundation wall and shall extend a minimum of 10 feet vertically into the earth. Where a counterpoise is provided, rods shall be interconnected with the counterpoise.

2.7 FASTENERS

A. General: Conductor fasteners shall be manufactured of a material which is compatible with the type of conductor being supported. Fasteners shall be of sufficient strength to properly support each conductor or terminal base, etc.

2.8 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Equipment manufactured by Thompson Lightning Protection, Inc., Harger Lightning Protection, Independent Lightning Protection or East Coast Lightning Protection shall be considered acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS

A. General: Conductors shall be installed to interconnect all air terminals to the system of grounding electrodes, and in general provide a minimum of at least 2 paths to ground from any air terminal on the system. Conductors shall provide a horizontal or downward path between the system air terminals and grounding electrode system.

B. Routing: Conductors shall be routed in such a manner that maximum concealment from public view is achieved. Down conductors may be installed in one-inch PVC conduit from roof to grade.

C. Counterpoise Conductors: Counterpoise conductors shall be installed after finished grades are established to insure specified depth and to minimize the possibility of damage. Any counterpoise conductor which is cut or damaged shall be repaired or replaced with no additional cost to the contract.

D. Connections: All connections between conductors below grade shall be exothermically welded. Improper application of weld shall be replaced at no additional cost to the contract.

3.2 INSTALLATION OF GROUND RODS

A. General: Ground rods shall be installed vertically at each down conductor position at a minimum of 2 feet from the building foundation wall. Inspection and documentation at each grounded location, weld, depth of counterpoise, etc., shall be made prior to backfill. Contractor shall notify engineer in writing to request inspection of underground work and for L.P.I. inspection before backfill. Allow a minimum of one week for engineer to make the inspection after notification from contractor.

B. Test/Inspection Wells: Provide traffic-rated, prefabricated test and inspection wells for all ground rods installed in paved or concrete areas.

3.3 INSPECTION WELLS

A. Location: Provide inspection wells for all ground rods covered by concrete, paving, landscape material or other permanent materials that prevent access to ground rods.

B. Description: Inspection well shall be provided with circular, flush traffic rated, grade mounted, twist lock traffic cover with the word “ground” (or similar) on the cover. Inspection test well shall allow clear access to the ground rod and exothermic weld connection of conductor to ground rod. Clearly mark ground rod locations on as-built drawings.

3.4 BONDING OF SECONDARY METALLIC BODIES

A. Structure Grounding: Provision shall be made at the roof level on reinforced concrete structures for bonding between the roof or down conductors, metallic elements of the roof system and metallic exterior wall systems.

B. Bonding: All down conductors run in concrete columns shall be bonded to the reinforcing steel at the top and the bottom of the column.

3.5 GENERAL WORKMANSHIP

A. General: All elements of the Lightning Protection System shall be installed in a professional and workmanlike manner consistent with the best industry practices.

B. Concealed Installation: All system components shall be concealed to the maximum extent possible to preserve the aesthetic appearance of the project building on which the system is installed.

3.6 COORDINATION WITH OTHER TRADES

A. Coordination: The Contractor shall coordinate his work with all trades, to insure the use of proper materials and procedures in and around the roof in order not to jeopardize the roofing warranty.

B. Fasteners: Where fasteners are to be embedded in masonry or the structural system, they shall be coordinated to insure installation at the proper time of construction.

C. Certification: Upon completion of the installation the Contractor shall provide to the owner the Master Label issued by Underwriters Laboratories, Inc. for the installation, and the LPI certification issued by LPI.

END OF SECTION 26 41 13

SECTION 26 43 13
SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

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. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.03 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. LEA International; Protection Technology Group.
2. Leviton Manufacturing Co., Inc.
3. Schneider Electric Industries SAS.
4. Siemens Industry, Inc.

2.02 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be at least 125 percent of the nominal system voltage.

2.03 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status
e. Surge counter.

B. Comply with UL 1283.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V, 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277, V 700 V for 208Y/120 V.
3. Neutral to Ground: 1200 V for 480Y/277, V 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V, 1200 V for 208Y/120 V

E. SCCR: Equal or exceed 100 kA.

F. Inominal Rating: 20 kA.

2.04 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.05 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 26 51 00
INTERIOR LIGHTING

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. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

1.03 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.04 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

B. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70 and all local ordinances.

1.06 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    b. UV stabilized.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

    a. "USE ONLY" and include specific lamp type.
    b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
    c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
    d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
    e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
    f. CCT and CRI for all luminaires.

2.02 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3: EXECUTION

3.01 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure. Provide two (2) independent support wires or rods for each fixture.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.02 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

END OF SECTION 26 51 00

SECTION 27 00 10
TECHNOLOGY GENERAL PROVISIONS

PART 1: GENERAL

1.01 GENERAL CONDITIONS AND DEFINITIONS

A. Scope: This specification section applies to all Division 27 specification sections and all Division 28 specification sections with the exception of Fire Alarm. All systems under the specifications indicated above are referenced also in this contract documents as “technology systems”.

B. Drawings and specifications: The words “drawings” and “specifications” used on this section refer to all contract drawings and specifications describing the scope of work of the technology system.

C. Installer and Contractor: The word “installer” where used on the drawings or specifications without any further description shall reference the installer of the system under reference. The word “contractor” where used on the drawings or specifications without any further description shall reference to the General Contractor (or Construction Manager) holding the prime agreement with the owner for the construction of this project.

D. Provide and Install: The word, "provide" where used on the drawings or specifications shall mean, "furnish, install, mount, connect, test, complete, document and make ready for operation". The word "install" where used on the drawings or specifications shall mean, "mount, connect, test, complete, and make ready for operation".

E. The word Engineer (also referenced as A&E) where used on the drawings or specification refers to the design engineer of the project working for the project architect or the owner. It does not refer to an engineer working for the General contractor, Construction Manager or any of the installers in the project.

F. Complete systems: All technology systems are intended to be complete systems, including all materials, labor and programming to make it an operation system. Refer to attachment 2 of this specification section for “Responsibility Matrix” document outlining the responsibility of each trade on each technology system.

G. Active equipment: Active equipment is defined as equipment composed of electronic component and electric materials, design to work with power applied to it. Cables are not considered active equipment.

1.02 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

A. Objective: The intent of the design drawings and specifications is to provide the installer of a technology system a scope of work for bidding purposes and to make sure different bids received by the entity holding the bidding for the technology system are at the same level of scope for comparison purposes. The drawings and specifications are not intended to show every single element of the project to produce a buyout list for the installer. In general, for all technology systems, all active components are specifically called out but small wires and small installation materials (such as nut, bolts, washers, termination blocks, clamps, ties, etc) are not indicated in the documents. Guidelines for installation of those systems are provided in the specification to allow the installer to produce the complete buyout list of materials.

B. Accuracy: The Drawings are diagrammatic and are not intended to show exact locations of conduit runs, outlet boxes, junction boxes, pull boxes, etc. The locations of equipment, appliances, fixtures, conduits, outlets, boxes and similar devices shown on the Drawings are approximate only. Exact locations shall be as accepted by the Architect or Engineer during construction. Obtain in the field all information relevant to the placing of technology systems work and in case of interference with other work, proceed as directed by the Architect or Engineer.

C. Distances: Although most drawings have a scale referenced on each sheet, the drawings are a two dimensional representation of the system, so design drawings do not indicate changes in elevation that cause additional lengths and quantities of materials. It is the responsibility of the installer of each technology system to field verify all distances before bidding to properly estimate all cable distances and materials.

D. Discrepancies: Notify the A&E of any discrepancies found during construction of the project and do not proceed with that portion of the project, until a written definitive statement is received providing clear direction. If a conflict exists between the contract documents and any applicable code or standard, the most stringent requirement shall be included for this project. The Engineer shall make the decision regarding questionable areas of conflict.

E. Existing Conditions: All existing conditions might not be indicated in the design drawings. The installer of each system shall check site and existing conditions thoroughly before bidding and advice the Engineer of discrepancies prior to bid.

F. Coordination: Although design technology drawings were intended to be coordinated with other trades, the fact that installer for other non-technology system might have changes to their design drawings, requires the Contractor to produce coordination drawings for a specific space, including all elements of all trades for space planning and coordination purposes.

1.03 ABBREVIATIONS

A. Abbreviations: The following abbreviations or initials may be used:

1. ABV CLG - Above Ceiling
2. AC - Alternating Current
3. ADA - American Disabilities Act
4. AFF - Above Finished Floor
5. AFG - Above Finished Grade
6. AMP - Ampere
7. ANSI - American National Standards Institute
8. AWG - American Wire Gauge
9. BC - Bare Copper
10. CCTV - Closed Circuit Television
11. CATV - Community antenna television
12. CLG - Ceiling
13. COAX - Coaxial Cable
14. CPU - Central Processing Unit
15. DC - Direct Current
16. DEG - Degree
17. EMT – Electrical Metallic Tubing
18. GND - Ground
19. IDF - Intermediate Distribution Frame (Telecom Room)
20. IMC - Intermediate Metallic Conduit
21. IN - Inches
22. IP - Internet Protocol
23. JB - Junction Box
24. KVA - Kilo-Volt-Amps
25. KW - Kilowatts
26. LBS - Pounds
27. LED - Light Emitting Diode
28. MAX - Maximum
29. MDF - Main Distribution Frame (Main Telecom Room)
30. MIC - Microphone
31. MIN - Minimum
32. MTD - Mounted
33. MTG - Mounting
34. NEC - National Electrical Code
35. NECA - National Electrical Contractors Association
36. NEMA - National Electrical Manufacturers Association
37. NFPA - National Fire Protection Association
38. NIC - Not in Contract
39. OFE - Owner furnished equipment
40. OSHA - Occupational Safety and Health Administration
41. PB - Pullbox
42. PWR - Power
43. PVC - Polyvinylchloride
44. EF - Telecommunications Entrance Facility
45. TR - Telecommunications Room

46. TTB - Telephone Terminal Board
47. V - Volt
48. WP - Weatherproof

1.04 CODES AND STANDARDS

A. Application: The codes, standards and practices listed herein generally apply to the entire project and all technology systems. Other codes, standards or practices that are more specific will be referenced within a particular specification.

B. Requirements: All articles, products, materials, fixtures, forms or types of construction covered in the specifications will be required to meet or exceed all applicable standards of manufacturer, testing, performance, capabilities, procedures and installation according to the requirements of ANSI, NEMA, IEEE, NEC, BICSI and TIA referenced documents where indicated and the manufacturer's recommended practices. Requirements indicated on the contract documents which exceed but are not contrary to governing codes shall be followed.

C. Compliance and Certification: The installation shall comply with the governing state and local codes or ordinances. The completed technology system installation shall be inspected and certified by all applicable agencies that it is in compliance with all codes.

D. Applicability: The codes and standards and practices listed herein, and their respective dates are furnished as the minimum latest requirements. List of applicable codes:

1. State Administrative Code
2. Building Code, current version
3. Manuals: Accessibility Requirements Manual -.

E. UL Labels: All materials shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. No equipment shall be installed if there is no labeling or listing service is available for such equipment.

1.05 MATERIALS ALTERNATES AND SUBSTITUTIONS

A. Definitions:

1. Basis of design: A product or group of products from an identified manufacturer that was used as the basis of systems layouts and installation details, part of the contract documents.
2. Prototype: Is a product or a group of products that are not yet ready for commercial use because they are in the testing phase (Beta testing) of the product development.
3. Alternates: Products or manufacturers listed in the contract documents as acceptable compare to the basis of design. Use of alternates shall follow the same system architecture as the basis of design.
4. Obsolete: A product that has been discontinued by the manufacturer or declared in end of life, and it is no longer being manufactured.
5. Substitution: A product not listed in the contract documents but capable of similar characteristics as the basis of design operating as a direct replacement in the system in reference. The installers can propose a substitution if all requirements are meet as indicated in this specification.
6. Substitutions that create a change in system architecture are products that create a very different system configuration impacting other trades (i.e. change in power/cooling requirements, changes in raceways layout or sizes, changes in equipment space requirements, changes in low voltage wiring layouts, types and quantities, etc) but providing a similar end result as the system/products basis of design.

B. Use of Prototype. Prototypes are not allowed in any technology system.

C. Use of alternates. Alternates are allowed and installer shall follow these requirements:

1. Where several brand names make or manufacturers are listed as acceptable alternates each shall be regarded as equally acceptable, based on the design selection. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to Engineer's review and acceptance. Where three or more manufacturers are listed, one of the listed manufacturers shall be submitted for acceptance.
2. The use of alternate products does not allow the change of system architecture with such products.

D. Use of substitutions. Substitutions are only allowed when they meet all the requirements below:

1. Substitutions are only allowed when a particular specification section for a technology system, allows the use of substitutions for that particular system.

2. The performance of all substitutions components must meet or exceed those of the basis of design. Should an installer wish to submit a substitution product or a product set stated in the construction documents as 'acceptable', it shall be the responsibility of the installer to submit to the Engineer an item-for-item CROSS REFERENCE for all specifications of the product, all related specifications and product data sheets, for the proposed substitution. Use the substitution request form indicated in Addendum 1 of this specification.
3. The Engineer has the authority to reject a substitution without cause and the installer shall provide the basis of design and no additional compensation.
4. Substitutions of unnamed manufacturers will not be acceptable.
5. Certification of substitutions: When a basis of design is specified to be in accordance with a trade association or government standard requested by the Engineer, installer shall provide a certificate that the substitution complies with the referenced standard. Upon request of Engineer, Contractor shall submit supporting test data to substantiate compliance.
6. Substitutions that create a change in system architecture are allowed under the following conditions:
    a. Substitution request for this type of system requires submitting the overall cost of substitution including the cost of changing other systems affected as well as the re-design cost for such systems. Without this information this type of substitution will not be evaluated at all.

1.06 SHOP DRAWINGS AND SUBMITTALS

A. General: Shop drawings shall be submitted for equipment and material as indicated in the individual specification sections for each system.

B. Quantity of shop drawings submittals: Follow Division 1 requirements for quantity of shop drawings and submitting requirements. If the project does not have a Division 1 specification, shop drawings shall be submitted in quantity of one (1) for electronic format submittal and quantity of four (4) for hardcopies.

C. Electronic submittals. Submittals in electronic format (PDF) are accepted.

D. When cut sheets of products are submitted and the manufacturer cut sheets indicate several model numbers or variations of the same product, the cut sheet shall be highlighted by the installer to indicate the specific product that will be provided for this project. Submittals received with cut sheets indicating multiple parts numbers and not highlighted will be rejected and not reviewed.

E. Equipment and material quantities are not reviewed by the A&E as part of this submittal process. Equipment quantities are to be provided by the installer as indicated in contract documents. Approved shop drawings indicating any changes in equipment quantities or overall scope of work different from contract documents does not constitute approval by the A&E of those changes. The contract documents and any changes issued by the A&E in the form of Supplemental Information during the construction process are always to be followed for equipment quantities and scope of work.

F. All electronic equipment prone to obsolescence and with lead times less than 3 months shall be submitted for approval no sooner than 12 month before the date set for substantial completion of the project. Electronic equipment prone to obsolescence includes devices like flat panel displays, transceivers, servers, players, workstation and routers

G. Equipment and materials installed not in accordance with the approved shop drawings shall be replaced at installer’s expense.

H. Multiple stages of shop drawings shall be required as indicated in each specification section. For final completion and testing the installer shall provide a submittal with the following information:
    1. Detailed course syllabus for each type of training required in the specifications
    2. A proposed schedule of training sessions in compliance with the specification sections and indicating place where the training will take place.
    3. A copy of all training material to be used during each session.
    4. Test result sheets for all testing done by the installer prior to the system acceptance test.

PART 2: PRODUCTS

2.01 IDENTIFICATION AND LABELING TAGS

A. All conduit, cabinets, cables, wires, wiring forms, terminal blocks, and terminals shall be clearly identified with pre-printed labels or tags.

B. The only approved types of labels for inside premise environments for any technology systems are:

1. Non-laminated thermal transfer labels, printed with a high quality thermal transfer printer.
2. Laminated thermal transfer labels printed with a high quality thermal transfer printer.
3. Thermal transfer polyolefin tape printed with a high quality thermal transfer printer.
4. Self laminated dot-matrix labels, printed with a high quality dot matrix printer.
5. Non-laminated dot-matrix labels, printed with a high quality dot matrix printer.

C. For labeling of cables or equipment in outdoor environments use only marker plates attached to cable or equipment with cable ties. Do not use any labels with adhesive materials. Use different color plates for different cable types. Use only waterproof ink for writing on marker plates.

D. Any type of write-on labels (except for outdoor marker plates), hand writing on cable jackets or directly on equipment, labels made with masking tape or any other type of tape not listed in previous paragraph are not acceptable and shall be corrected with approved labeling methods at no additional cost to the owner.

E. Approved manufacturer:

1. Rhino,
2. Brady,
3. Panduit or
4. approved equal

2.02 TECHNOLOGY EQUIPMENT AND MATERIALS

A. General: Each item of equipment or material shall be manufactured by a company regularly engaged in the manufacturer of the type and size of equipment, shall be suitable for the environment in which it is to be installed, shall be approved for its purpose, environment, and application, and shall bear a label as indicated in paragraph 1.4.E. of this section.

B. Installation Requirements: Each item of equipment or material shall be installed in accordance with instructions and recommendations of the manufacturer and the contract documents.

C. Required Accessories: All equipment specified in the technology systems shall be provided with all required accessories for proper operation and mounting. Typically these accessories are not specifically indicated in the design drawings but shall be provided per this specification section. Such accessories include items such as power supplies, power cords, rack ears, rack rails, bolts, lugs, faceplates, etc.

PART 3: EXECUTION

3.01 INSTALLATION PRACTICES

A. WORKMANSHIP: The installation of materials and equipment shall be performed in a neat, workmanlike and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the Contract Documents. They shall be skilled in the methods and craftsmanship needed to produce a quality level of workmanship. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.

B. STANDARD OF QUALITY: To define good workmanship, all installation practices described in BICSI standards shall be followed.

C. PROTECTION OF EQUIPMENT: Equipment for Technology systems shall at all times during construction be adequately protected against mechanical/chemical damage by the elements or work perform by other trades. Equipment shall be stored in dry permanent shelters. If equipment or materials has been damaged, such equipment shall be replaced at no additional cost or time extension to the Contract. Damaged equipment and materials include the following conditions:

1. Equipment that has visible scratches, cracks or equipment that has paint or finished surface peeled off.
2. Equipment with visible indication of rust or water intrusion.
3. Equipment that has dents on the metal enclosures and are clearly visible to the end user.
4. Equipment that has been sprayed with paint, fire proofing materials, or other type of chemicals, when the equipment was not intended to have this type of materials applied to it, per contract documents.
5. Equipment that has been burnt by controlled fires, power surges, power sags or by lightning.
6. Equipment that has a known damage to any parts, electronic board or component, even if such component or board has no specific use in the project.

7. Cables that have visible damages to the jackets even if cables are not broken and still provide electrical continuity.
8. Cables sprayed with paints that affect the warranty of the cable as defined by the cable manufacturer.
9. Equipment with screws with stripped heads.

D. CLEAN EQUIPMENT: All equipment installed in spaces accessible to the building occupants like in racks, cabinets, wall mounted panels, credenzas, etc. shall be free of dust at the time the space part of the project gets the final Certificate of Occupancy and at the time of the acceptance test by the A&E. A clean equipment is defined as an equipment that if wiped with a finger, in any surface, does not leave visible debris and dust in the finger, also equipment with no visible signs of dust inside the equipment, like in ventilation fans.

E. IDENTIFICATION AND TAGGING: All technology systems items shall be labeled and identified as specified in the Contract Documents. Such identification shall be in addition to the manufacturer's nameplates and shall serve to identify the item's function and the equipment or system which it serves or controls. Refer to Identification Section of the specifications for additional information. All labels of equipment and wiring shall match the labeling used in the shop drawings for the system.

3.02 COORDINATION

A. General: The installer shall compare shop drawings with those of other trades and report any conflicts between them to the A&E. Obtain from the A&E written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing interrelated work.

B. Adjustments: Locations of conduit and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Determine the exact routing and location of all systems prior to fabrication or installation.

C. Replacement: All work shall be installed in a way to permit removal (without damage to other parts) of all other system components provided under this Contract requiring periodic replacement or maintenance. All conduits shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles.

3.03 REQUEST OF IP ADDRESSES

A. General: When contract document require the installer of any of the technology systems to use IP addresses for the configuration of such system, inside the owner’s controlled IP network, the installer shall request the owner to provide such IP addresses. The installer shall request such information no less than one (1) month in advance from the moment the installer will be programming the system and by using the form named “Network Connections Programming Plan” indicated in Attachment 3 of this specification. An electronic copy of this form is available upon request from TLC Engineering.

B. Completing the form. The Network Connections Programming plan shall be completed in separate by each trade that requires IP addresses. This form has two parts. The first part indicates all the different device types for a system (i.e. cameras, workstation, servers, controllers, VoIP phones, etc). The second part is a list of all devices required classified by their type and properly indicating location where the device will be used.

C. Request that do not follow this process, or have incomplete information will be ignored and will not be processed.

D. Reprogramming cost of any technology systems due to un-approved addresses used by the installer shall be at the installer’s expense

3.04 TELECOM ROOM/EQUIPMENT ROOM READINESS

A. In any projects where the technology systems require the use of network equipment (switches, routers, firewalls, etc) provided by the owner, the Contractor shall complete all telecom rooms to a point where they are suitable for the owner to deploy such equipment in those rooms. At a minimum the following conditions shall be meet at all rooms in order for the owner to install the equipment:

1. All power outlets in the telecom rooms shall be fed from the permanent source of power. Temporary power shall not be provided.
2. Backup power (generator and/or UPS) shall be already operation, tested and connected to the final power distribution system.
3. The mechanical equipment providing the cooling for the telecom rooms shall be fully operational. Temporary cooling shall not be accepted.

4. Fire suppression system (sprinkler or gas based system) protecting the telecom rooms shall be fully operational and tested.
5. All light fixtures in the telecom rooms shall be fully operational.
6. All walls to the telecom rooms shall be completed and including the last coat of paint.
7. The ceiling and flooring of the telecom rooms shall be finished.
8. All horizontal and backbone cabling system part of the structured cabling system (SCS) shall be installed, terminated and tested.
9. The final and permanent doors to the telecom rooms shall be installed with a key core different from all other construction cores in the site.
10. Telecom rooms shall be cleared of any materials being stored inside the room.
11. Telecom rooms shall be clean. Clean will be measured as not having any debris left in the room and not having dust in rack, cabinets, or wall mounted panels. If wiping a finger in any of the surfaces of such equipment leaves visible dust residue in the finger, the room will not be considered clean.
12. Hallways and rooms leading into the telecom rooms shall have no more sanding to be done in the walls and the floor shall be completed to avoid dust from these spaces moving into the telecom rooms.
13. Prior to the owner deploying the equipment in these rooms, the Contractor shall provide disposable sticky mats at the entrance of each telecom room to capture dust and/or dirt from people's shoes or boots coming into the room. The sticky mats shall be selected as to cover the width of the door opening. Sticky mats shall contain no less than 60 sheets in each unit. Used sheets of the mats shall be replaced no less than on a daily basis or if worn out before the end of the day. Sticky mats shall be provided until the project receives the final Certificate of Occupancy.

B. In projects where the network equipment is part of the contract documents, the contractor is required to provide all equipment functioning and clean at the end of the project. The contractor is responsible to determine at what point this delicate equipment can be installed in the telecom room. The contractor shall make sure the recommended manufacturer guidelines are applied to the installation of the equipment when it comes to cleanness. It is highly recommended that all steps indicated above are followed even for this type of project.

3.05 SYSTEMS WARRANTY AND SERVICE

A. General: At a minimum all technology system shall include a warranty from the manufacturer and installer of the system for no less than one (1) year with the following exceptions:

1. Structured Cabling system shall have a warranty longer than one year as indicated in that specification section.
2. When specific equipment or software manufacturers include a warranty longer than one year, the manufacturer's warranty shall be transferred to the owner in the same terms as indicated by the manufacturer.

B. Warranty coverage. The warranty for the technology system shall cover the following elements:

1. All equipment parts, cabling and materials.
2. Any software updates/patches issued during the warranty period by the manufacturer.
3. The labor to replace those parts and programming time to re-configure equipment.
4. Shipping and freight charges to send equipment back and forth from the manufacturer and/or site.
5. Tool rentals such as scaffold or lifts to access equipment.
6. The troubleshooting time to detect the faults in the system.
7. All travel time and expenses associated with the service.

C. Start of warranty. The warranty period for the technology systems starts the day the project gets the Certificate of Occupancy (CO), for new construction projects. For retrofit jobs of a particular system, the warranty starts when the project is accepted by A&E. For most equipment/software manufacturer's the warranty period starts when the equipment is shipped from the factory, so it is the responsibility of the installer of each system to provide additional warranty coverage from the manufacturer to cover the additional time of warranty up to the CO date plus one year.

D. Service calls. During the warranty period the installer shall support the system when called by owner/contractor for service. All equipment/software service shall be done by personnel with the same qualifications as the personnel who installed the system and as indicated in each technology system specification section. Service calls shall be taken during business hours (same time zone as the project) for normal service and twenty (24) hours three hundred and sixty five (365) days in the year for emergency service. Emergency Service shall be defined as the loss or failure of any critical component necessary to maintain the overall integrity and operation of the system. Normal service shall be defined as the loss or failure of a system component that does not compromise the complete operation of the system and allows the owner to operate the system at a minimum of 90% of its capacity. See individual specification sections for delineation on critical components and normal service.

E. Response time for service. The maximum allowed response time after a service call for emergency service shall be four (4) hours and for normal service twenty four (24) hours.

F. Equipment registration. All equipment/software part of the technology system shall be registered to the owner with the manufacturer of the equipment/software for warranty and support. Equipment/software registered with the manufacturer to the name of the Contractor or installer shall be removed from the project and replaced with equal equipment registered to the owner at no additional cost to the owner.

G. Periodic preventive maintenance visits. During the warranty period the installer of the system shall provide no less than two (2) preventive maintenance services. These services shall be provided at 6 months from start of the warranty period and a few weeks before the end of the warranty period. The installer of the system shall coordinate with the owner the precise dates for this type of service. During these visits the following task shall be perform:

1. Clean up of any active equipment that shows visible accumulation of dirt, dust of debris of any kind.
2. Replacement of any consumable parts in the system that require replacement per manufacturer's instructions during the warranty period, such as filters.
3. Oiling/greasing of any mechanical parts that require period maintenance as per manufacturer's instructions during the warranty period.
4. Run manufacturer's recommended test for each piece of equipment installed. The installer shall provide at the end of the service a report of such test.
5. Visual observation of all devices in the system to spot any anomalies.
6. Review of error logs from any system components and analysis of such logs with explanation to owner on the cause of those errors.

H. Extended service agreement. Prior to final acceptance testing, and within thirty 30-days of project completion, the installer of each technology system shall submit to the Owner an option to purchase extended service coverage. This proposal shall provide for the purchase option of 1, 3, or 5, year coverage. Coverage shall include, at a minimum, the same provisions as during the warranty period.

3.06 ENGINEER'S FINAL ACCEPTANCE TEST

A. The technology systems shall be tested during installation by the installer as frequently as required to solve any installation issues and non compliance of system specifications. Technology systems will not be considered delivered to the owner until final acceptance test is passed. The final acceptance test shall be done in presence of the A&E and/or the owner. The installer shall request in writing with 2 weeks in advance the presence of the A&E and/or owner for the final acceptance test.

B. In order for the installer of the system to request final acceptance the following task shall be completed:

1. All components shall be inspected to ensure they have been properly installed by the installer, securely attached, and remain clean and unmarred
2. All equipment shall be properly adjusted, clearly labeled, and fully operational.
3. The installer shall have tested the system previously to ensure the final acceptance test will be successful. Detailed proof of test shall be sent to the A&E with the request for final acceptance
4. All permanent and final labels as requested in the identification and tagging section of this specification are completed.
5. No temporary conditions shall be present in the system.
6. All batteries on all system components shall be connected.
7. All system programming shall be completed as indicated in the specification for each technology system.

C. All test equipment required for the Final acceptance shall be provided by the installer of the system unless specifically indicated by the A&E.

D. The A&E shall define the scope of the testing but the installer shall be prepared for testing every single component of the system. During the day of the test the A&E will indicate the testing process and procedures for each system. Test could include operation of the system during power outages. The installer of the system shall be available during the complete testing process to answer questions from the Engineer and to demonstrate specific parts of the system. If personnel form the installer or test equipment is not available, the test will be considered and marked as a failure.

E. A punch list of the items to be corrected will be prepared by the A&E during the final acceptance test. The installer shall correct all items and request a second day for verification of all punch-list items by the A&E and Owner. During the second test, no additional punch list items shall be expected, and only the items in the punch list will be tested.

F. If during the testing process the A&E and/or Owner consider that the rate of failure of the test is too high (more than 5 failures or non-compliance with specifications in one hour of test), the test will be cancelled unilaterally by the A&E and/or owner. The installer shall correct all items and re-schedule the final acceptance test again. The new test will start over from the beginning and nothing previously tested will be accepted. The installer shall not be entitled to additional compensation for the additional effort to test the system during this condition. Upon successful completion of the final acceptance test the installer of the system will receive a written notice by the A&E and/or Owner acknowledging the acceptance of the test

G. See individual specification sections for system specific requirements for testing.

3.07 TRAINING AND INSTRUCTION

A. Training for each technology system shall be provided as indicated in this specification and in the individual specification section for each system.

B. The following training guidelines shall be followed for all technology system:

1. Training shall not be scheduled in a way that no attendee or presenter shall be required to attend more than 6 hours of training per day.
2. Prior to starting all training, the training submittal shall be approved. See section one of this specification for details on the training submittal
3. No training shall be scheduled prior to the system being completed and accepted by the A&E.
4. Training shall be conducted during normal business hours of the client, at a date and time of mutual convenience to the Owner and installer. All training sessions need to be scheduled by the installer at least 2 weeks in advance. The Owner shall be notified in writing by the installer on when are the possible dates for each session.
5. All different types of training shall be videotaped and delivered to the owner as part of the close out information in digital copy. All tapes shall be recorded in hi-quality MPEG2 or HD recorders, and the media turned to the owner shall be in electronic format viewable through QuickTime or Windows Media Player.
6. The installer is responsible for completing list of attendants for each session of training. All these sheets shall be submitted as part of the close out information

3.08 AS BUILT DOCUMENTS

A. Production: During the course of this project the contractor shall maintain record "as-built drawings". One set shall be maintained at the site and at all times and it shall be accurate, clear, and complete, showing the actual location of all equipment as installed. The "As-Built" drawings shall show all technology systems work installed complete to the present stage of progress. These drawings shall be available for review by the A&E's field representatives at all times.

B. Completion: At the completion of the Work, transfer onto the second set of drawings all changes marked in colored and submit to the A&E.

C. Final: Upon installer’s completion of the Engineer's final punch list, transfer all "As-Built" conditions and all requirements by the Engineer to a reproducible set of drawings. Submit full size drawings and one (1) set of CAD/Autodesk Revit© disks for review and acceptance.

D. Additional documents. At project completion, the installer of the technology system shall provide, as part of the as-built documents, updated tables, equipment schedules, configuration worksheets and labeling system used. See individual system specification section for more details on these documents.

E. See individual specification sections for each system for additional requirements for As-Built documents.

3.09 CLOSE OUT DOCUMENTS

A. Closeout information shall be provided to the owner in electronic format at the end of the project. The file shall be organized by each system and shall follow this organization:

1. PART 1 – OPERATION AND MAINTENANCE MANUALS. Operation and Maintenance manuals as issued by the manufacturer of each system's component. Such manuals shall include all maintenance procedures required to be done by the owner. Also, when required by each individual specification section, a short form operation guide, prepared by installer) for the system.
2. PART 2 – INVENTORY OF EQUIPMENT INSTALLED. A detailed list of all relevant active equipment (equipment with electronic components with a market value over $200) installed in the project including the following information and presented in electronic format (Microsoft Excel):
    a. Make
    b. Model
    c. Serial number
    d. Room location
    e. Warranty period, including manufacturer's extended warranties.
3. PART 3 – PROOF OWNERSHIP, DELIVERY AND ACCEPTANCE. The following letters/documents shall be attached in this part:
    a. Acceptance letter signed by A&E for each of the technology systems installed.
    b. Proof of training by submitting sign in sheets for each training session done
    c. Signed transmittal for all training videos and training material.
    d. Signed transmittal for all spare parts and consumables delivered to the owner.
    e. A list of all the user names and passwords for all the different software programs used by the technology systems and any equipment with password codes. All levels of passwords shall be provided, from the lowest hierarchy to the highest.
    f. At least four (4) copies of all physical keys to different devices part of the technology systems. Each key shall be individually tagged in a key ring. All keys shall be included and organized inside a key ring management enclosure.
    g. A list of all software modules and licenses delivered to the owner. The list shall include part numbers, serial numbers, license certificate of authenticity, hardware key (dongles) numbers and software version. This list shall have a clear signature, name and date on person that received this software by the Owner.
    h. A copy of all official equipment and software registrations with manufacturer.
4. PART 4 – AS BUILT DOCUMENTS. All as-built documents as indicated in this specification section

END OF SECTION 27 00 10

ATTACHMENT 1 – SUBSTITUTION REQUEST FORM

Substitution Request Number: _____

PROJECT: _____ DATE: _____

SPECIFICATION SECTION: _____ ITEM(S): _____

SPECIFIED MANUFACTURER: _____

SPECIFIED MODEL NO: _____

PROPOSED MANUFACTURER: _____

PROPOSED MODEL NO: _____

REASON(S) FOR NOT PROVIDING SPECIFIED ITEM: _____

_____

Attach product description, drawings, photographs, performance and test data, samples and other information necessary for side-by-side evaluation. Fill in all blanks.

A. Provide substantiated reason for requested substitution.

B. Does the requested substitution affect dimensions, locations or configurations?

No: _____ Yes: _____

Explain (attach drawings if necessary): _____

_____

_____

C. What are the differences between the specified item and the requested item:

_____

_____

D. Will the Contractor pay for any changes to the building design, including engineering and detailing costs caused by the approval?

No: _____ Yes: _____

Explain (if no, and describe modifications required to install or accommodate the requested change): _____

_____

_____

E. Will approval affect the work of other trades, including the Construction schedule?

No:_____ Yes:_____

Explain (if yes):_____

_____

_____

F. Manufacturer's guarantees of the proposed and specified items are:

Same:_____ Different:_____

Explain (if different):__

_____

_____

G. Does the proposed item meet all applicable codes, ordinances and regulations for this specific application?

No:_____ Yes:_____

Explain (if no):_____

_____

_____

H. Has proposed item been used locally in similar applications?

No:_____ Yes:_____

Explain (give nearest location):_____

_____

_____

I. Will maintenance and service parts be locally available for the requested item?

No:_____ Yes:_____

Explain (if no, give nearest location):_____

_____

_____

J. Will the requested item require waiving of any qualifications or other requirements?

No:_____ Yes:_____

Explain (if yes):_____

_____

_____

K. Are there any license fees or royalties associated with the requested substitution?

No:_____ Yes:_____

Explain (if yes):_____

_____

_____

L. If approved, will the Owner receive a credit for the proposed alternate material?

No:_____ Yes:_____

Explain (if no):_____

_____

_____

M. Does the proposed alternate material meet the same applicable standards (ASTM, ANSI, UL, FS) as the specified item?

No:_____ Yes:_____

Explain (if no, attach drawings if necessary):_____

_____

_____

N. Identify the recycled materials or components or features that lead to the claims to being "Green": _____

_____

_____

O. Has the required line-by-line comparison been included?

No:_____ Yes:_____

Explain (if no):_____

_____

_____

The undersigned agrees to pay for the Designer's review time and for changes to the building design, including review, re-design, engineering, drawings and other costs caused by the requested substitution.

_____

Signature

_____

Print

The following Purchase Order or billing number is to be used for billing the Contractor for costs incurred in evaluating and if applicable accommodating the requested substitution.

_____

The Engineer will not be required to approve any product that is not equal or suitable for the specific application and functionality of this project.

TLC ENGINEERING FOR ARCHITECTURE

NETWORK CONNECTIONS PROGRAMMING PLAN

PROJECT NAME	
DATE	

SUBCONTRACTOR	
TRADE	

TYPE OF DEVICES FORM (Fill one column per device type provided)						
DEVICES CHARACTERISTICS	DEVICE NAME		DEVICE NAME		DEVICE NAME	
	DEVICE CODE	A	DEVICE CODE	B	DEVICE CODE	C
Manufacturer						
Part Number						
Firmware version						
Is a fixed address required or can device work with a dynamic address (DHCP)?						
Does device requires an address from a DNS server?						
Does device support Layer 3 traffic (IP)?						
Does device needs access to the internet?						
Number of physical network ports per device?						
Does device requires IPv6 to work or IPv4?						
Does device supports SNMP?						
Does device needs specific TCP ports open? Please list						
Is this device connecting to existing network devices (Yes/no)						
If yes to above, please describe to what device, located where.						

TLC ENGINEERING FOR ARCHITECTURE

NETWORK CONNECTIONS PROGRAMMING PLAN

PROJECT NAME	
DATE	

SUBCONTRACTOR	
TRADE	

LIST OF DEVICES FORM (Fill one entry in form per each device being provided

DEVICE PHYSICAL LOCATION BUILDING AND ROOM #	DEVICE CODE FROM PREVIOUS FORM	DEVICE NETORK NAME	IP ADDRESS	SUBNET	GATEWAY	DNS SERVER	VLAN NAME

Filled out by Network administrator

SECTION 27 05 28
RACEWAYS FOR TECHNOLOGY

PART 1: GENERAL

1.01 RELATED DOCUMENTS

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

B. Section 260533 - Raceway Systems, apply to work of this Section. Specifications described herein take precedence over Section 260533.

C. Supplemental: Refer to the specification sections identified below for additional requirements, which are supplemented by this section.

1. 270010 - Technology General Provisions
2. 270526 - Grounding and Bonding for Telecommunications Systems

1.02 DESCRIPTION

A. General: Furnish and install complete with all accessories a Pathways and Spaces infrastructure for supporting of Structured Cabling System (SCS) and housing of technology equipment. The goal of the project is to provide a reliable architecture of the building that shall serve as a support for transport of data, voice telephony, security and audio/visual cabling throughout the building from designated demarcation points to places located at various wall, floor, ceiling, column, room and other locations as indicated on the contract drawings and described herein.

B. General: For pathways the system shall utilize a combination of conduit, cable tray and supports for vertical and horizontal cabling support. Pathways shall be provided and located as shown and in the quantities indicated on the drawings. Pathways shall terminate in rooms or closets using approved fasteners and termination hardware and bushings and shall be reamed to eliminate sharp edges. All Pathways shall be identified at all locations.

C. All installers should anticipate that all products and installation procedures shall comply with the ANSI/TIA-569-D requirements at a minimum.

D. General: Installation of the raceways for communications shall be a complete system including all supports and hangers as required per contract documents and manufacturer’s installation guidelines.

E. Support: All items shall be supported from the structural portion of the building. Supports and hangers shall be of a type approved by Underwriters' Laboratories. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels. Do not install any devices supported by ceiling tiles.

F. Installation: The Installer shall layout and provide his work in advance of the laying of floors or walls, and shall provide all sleeves that may be required for openings through floors, walls, etc. Where plans call for conduit to be run exposed, provide all inserts and clamps for the supporting of conduit.

G. Pull Strings: Provide pull strings in all raceways. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one (1) inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than one (1) inch shall have a tensile strength not less than 200 lbs.

H. Directional boring might be required in the drawings or the installer might choose this method as the way to install underground conduit on this project. In either case, the installer shall comply with the requirements indicated here for directional boring.

I. If at the time of bid and underground locate survey is not available, the installer shall include in the pricing the cost of this survey. No directional boring will be allowed without such survey being completed.

1.03 INSTALLER QUALIFICATIONS

A. General: The installer selected for the Project must be BICSI certified installer and certified by the manufacturer for the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning the Project.

B. General: The Installer directly responsible for this work shall be a " Pathways and Spaces for Structured Cabling System Installer (PS-SCS) " who is, and who has been, regularly engaged in the providing and installation of commercial and industrial pathways and spaces for telecommunications wiring systems of this type and size for at least the immediate past five years. Any sub-Installer who will assist the PS-SCS installer in performance of this work, shall have the same training and certification as the PS-SCS installer.

C. Certification: The installer's Project Manager shall possess a current and in good standing BICSI Registered Communications Distribution Designer (RCDD) certificate. All shop drawings submitted by the installer shall bear the RCDD's seal.

D. Experience: The Installer shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Installer shall own and maintain tools and equipment necessary for successful installation and have personnel who are adequately trained in the use of such tools and equipment.

1.04 MATERIALS ALTERNATES AND SUBSTITUTIONS

A. General: Substitutions are allowed for all components of the systems under this specification sections as long as all requirements for substitutions indicated in specification section 270010 are followed.

1.05 SHOP DRAWINGS AND SUBMITTALS

A. See additional requirements for shop drawings and submittals in specification section 270010.

B. General: The PS-SCS installer shall provide no later than 30 days after contract award the following information:

1. Proof of Installer's qualifications per paragraph 1.03.
2. Cut sheets of all products to be used for the project, highlighting in particular the precise product to be used in each case, when multiple devices are indicated in the cut sheet. At a minimum the following devices shall be submitted with this specification section:
    a. Supporting devices (j-hooks) if allowed in the project. See part 3 of this specification.
    b. Cable tray system with accessories
    c. Runway cable tray system with accessories.
    d. Plywood
    e. Trough wall/floor firestop system
    f. Innerduct
    g. Detectable tape
    h. Communications vaults
    i. Conduit waterfalls
    j. Fire stop system (for small penetrations)
3. Drawings indicating precise location and type of all support for cable tray or ladder tray systems in all areas where they will be used.
4. For all communication vaults, drawings shall be prepared indicating conduit penetrations on each side of each vault. Vaults shall be labeled to indicate their correct location in the site plan.
5. Pre-cast communications vaults shall be submitted with load calculations signed and sealed by a professional engineer.
6. For any directional boring runs, the installer shall provide a drawing indicating all underground locate surveys and the proposed routing of the conduit as well as proposed depth.

1.06 WORK EXTERNAL TO THE BUILDING

A. General: Any work external to the confines of this building as shown on the drawings shall be governed by provisions of this specification.

PART 2: PRODUCTS

2.01 CONDUIT

A. All conduits as indicated in Section 26

2.02 TELECOMMUNICATIONS OUTLET BOX

A. Telecommunication outlet electrical boxes shall be used to make terminations to limited energy systems described in Division 27 and Division 28 specifications. Telecommunications outlet boxes shall have the following specifications:

1. Material: Steel, 0.6858mm. thickness (minimum) with galvanized zinc coating, 0.013mm. (minimum) thickness on both sides of bracket
2. Construction: Cleanly punched knockouts, welded at 8 points (minimum) with softened edges (no sharp edges).
3. Size (HXW): 4”X4”
4. Depth: 2-1/8”
5. Knock outs: At least one of this dimension: 1”
6. Listing: UL or ETL

B. Telecommunications outlet electrical boxes shall be provided with the appropriate 1 gang or 2 gang rings selected for the proper thickness of the drywall in all areas. Standard telecommunications outlets shall use 1 gang ring, but design documents might indicate the use of 2 gang rings in selected areas.

C. Knockouts in telecommunications outlet boxes shall not be field punched.

D. Basis of design: Raco, Steel City, Randal Industries Inc,

2.03 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. HDPE pipe shall be used for all directional boring applications, or it can also be used for open trench applications. HDPE pipe shall comply with the following manufacturing standards:

1. ASTM D 3035 Polyethylene (PE) Plastic Pipe (SDR) Based on Controlled Outside Diameter.
2. ASTM D 2239 Polyethylene (PE) Plastic Pipe (SIDR) Based on Controlled Inside Diameter.
3. ASTM F 2160 Solid wall High Density Polyethylene (HDPE) Conduit based on Controlled Outside Diameter (O.D.)
4. NEMA TC-7 Smooth Wall Coilable Polyethylene Electrical Plastic Conduit.

B. HDPE pipe shall be manufactured from a suitable thermoplastic polymer conforming to the minimum standard of PE334420E/C as defined in ASTM D3350. The resin properties shall meet or exceed the values listed below for HDPE pipe:

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	0.941 - 0.955
D-1238	Melt Index, g/10 min Condition E	0.05 - 0.50
D- 638	Tensile strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B,F 20	96 min.
D-790	Flexural Modulus, MPa (PSI)	80,000 min.
D-746	Brittleness Temperature	-75°C

C. Design selection: The HDPE pipe used in this project shall be Rib/Smooth – Ribbed Interior and Smooth Exterior wall. Pipe shall be available in multiple colors, non lubricated and shall include a factory installed 1,800 lbs polyester pull tape. HDPE pipe walls shall be in compliance with SDR 7 - ASTM D3035 specifications and shall have footage markings.

D. Approved manufacturers: Carlon Industries or approved equal.

2.04 WIREWAYS

A. General: Wireway shall be sized as shown on drawings, NEMA 1, lay-in type. Wireway sides and bottom shall contain no knock-outs unless shown otherwise on the drawings. The Installer shall punch holes required. The cover shall be hinge type with quarter turn fasteners to hold cover shut. Covers and bodies shall be 16 gauge steel. Wireway shall be as manufactured by Hoffman Engineering Company, Square "D" or Steel City.

2.05 SUPPORTING DEVICES

A. Hangers: Hangers shall be made of durable materials suitable for the application involved. Where excessive corrosive conditions are encountered, hanger assemblies shall be protected after fabrication by galvanizing, or approved suitable preservative methods.

B. Non-continuous cable supports (j-hooks) shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; UL Listed.

C. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

D. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

E. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.

F. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.

G. Anchoring: Insert anchors shall be installed on concrete or brick construction, with hex head machine screws. Recessed head screws shall be used in wood construction. An electric or hand drill shall be used for drilling holes for all inserts in concrete or similar construction. Installed inserts, brick, shall be near center of brick, not near edge or in joint. Drilled and tapped, and round head machine screws shall be used where steel members occur. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Gunpowder or lead set anchors are not permitted.

H. Accessories: Non-continuous support systems shall be provided with the adequate mounting accessories depending on the location where the support will be installed, like beam clips, flange clips, C and Z purlin clips.

I. Accepted manufactures; Erico or Panduit.

2.06 CABLE TRAY AND FITTINGS (BASKET TYPE)

A. General Description: Basket type cable tray system is to be constructed of welded steel wire mesh with continuous safety edge wire lip. Provide mesh system permitting for continuous ventilation of cables and maximum heat dissipation.

B. Materials: Carbon Steel: Cable management system to be manufactured from high strength minimum 6 gauge steel wires. Wire to be welded and bent prior to surface treatment.

C. Finishes: Electro-plated zinc Galvanizing: Electrodeposited zinc coating applied to an average thickness of 0.7 mils to 0.8 mils. Equipment Gray: Powder painted surface treatment using ASA 61 Gray Polyester coating or as shown on the drawings.

D. Cable tray dimensions: as shown on the drawings.

E. Fittings: Cable tray fittings to be field manufactured from straight sections through use of hardware and instructions recommended by Manufacturer. Provide drop-off, 90° kits and tees as required using manufacturer fabricated products and installation guidelines.

F. Installation: Cable tray system to be installed using splice connectors, and support components as recommended by the Manufacturer.

G. Loading Cable tray system to be installed and supported per NEMA VE-2 and Manufacturer's suggested span load criteria.

H. The cable tray system shall be UL listed and classified as a continuous bonded tray system providing a continuous grounding path. Cable tray system is required to be tested for grounding adequacy per NFPA 70B, Chapter 18 with a maximum allowable resistance of 1 ohm.

I. Approved Manufacturers: Wiremold, Cablofil, Snake Tray, B-line, WBT or Chatsworth.

2.07 CABLE TRAY AND FITTINGS (LADDER TRAY TYPE)

A. CABLE TRAY SECTIONS AND COMPONENTS

1. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
2. Materials and Finish: Material and finish specifications for each cable tray type are as follows:
    a. Aluminum: Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.

b. Pre-galvanized Steel: Straight sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties and mill galvanized in accordance with ASTM A653 SS, Grade 33, coating designation G90.

c. Hot-dip Galvanized Steel: Straight section and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dipped galvanized cable tray. All hot-dip galvanized after fabrication steel cable trays must be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so can cause damage to cables and/or injury to installers.

d. Stainless Steel: Straight section and fitting side rails and rungs shall be made of AISI Type 304 or Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be welded to the side rails with Type 316 stainless steel welding wire.

B. TYPE OF TRAY SYSTEM

1. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 12 inches on center. Spacing in radiused fittings shall be 9 inches and measured at the center of the tray's width. Rungs shall have a minimum cable-bearing surface of 7/8 inch with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails. Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and a 200 pound concentrated load when tested in accordance with NEMA VE-1, section 5.4.
2. Ventilated trough type trays shall consist of two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable-bearing surface of 2-3/4 inches and shall be spaced 6 inches on center. To provide ventilation in the tray, the valleys of the corrugated bottom shall have 2-1/4 inch by 4 inch rectangular holes punched along the width of the bottom.
3. Solid bottom trough type trays shall consist of two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable-bearing surface of 2-3/4 inch and shall be spaced 6 inches on center.
4. Tray Sizes shall have 3inch minimum usable load depth, or as noted on the drawing.
5. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard 10 foot lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.
6. Tray widths shall be as shown on drawings.
7. All fittings must have a minimum radius as the width of the tray.
8. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.

    a. Aluminum Tray - Splice plates shall be made of 6063-T6 aluminum, using four square neck carriage bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633, SC1. If aluminum cable tray is to be used outdoors then hardware shall be Type 316 stainless.

    b. Steel (including Pre-galvanized and Hot-dip galvanized) - Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1. Each splice plate shall be attached with four ribbed neck carriage bolts with serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633 SC1 for pre-galvanized cable trays, or Chromium Zinc in accordance with ASTM F-1136-88 for hot-dip galvanized cable trays.

9. Splice plates shall be furnished with straight sections and fittings.
10. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum span indicated on drawings. Supports shall be constructed from 12 gauge steel formed shape channel members 1-5/8 inch by 1-5/8 inch with necessary hardware such as Trapeze Support Kits. Cable trays installed adjacent to walls shall be supported on wall mounted brackets. All types of supports shall be factory made supports supplied by the same manufacturer of the cable tray system as recommended for the type of cable tray selected.
11. Trapeze hangers supports shall be supported by 3/8 inch (minimum) diameter rods.
12. Barrier Strips: Shall be placed as specified on drawings and be fastened into the tray with self-drilling screws.

13. Accessories - special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, etc.

C. LOADING CAPACITIES

1. Cable tray shall be capable of carrying a uniformly distributed load of 109 lbs. /ft. on a 12 foot support span with a safety factor of 1.5 when supported as a simple span and tested per NEMA VE1 Section 5.2. In addition to the uniformly distributed load the cable tray shall support a 200 lb. concentrated load at mid-point of span and centerline of tray. Load and safety factors specified are applicable to both side rails and rung capacities.

D. Approved Manufacturers: B-line, Chatsworth or approved equal.

2.08 TUBULAR RUNWAY CABLE TRAY AND FITTINGS

A. Materials: ASIM A36 steel bar.

B. Finish: Baked Powder painted surface treatment using Polyester coating.

C. Finish color: to match equipment cabinet finish color. See specification section 271000.

D. Cable management tray width: as shown on the drawings.

E. Fittings: Cable management fittings and hardware recommended by Manufacturer. Provide drop-off, 90° and tees as required for the equipment served and support of the cable. Provide at least one large radius drop off for each rack/cabinet in the project.

F. Installation: Cable management system to be installed using support components as recommended by the Manufacturer.

G. Loading: Cable management system to be installed and supported per Manufacturer's suggested span load criteria.

H. Approved Manufacturers: B-line, GS Metals, Chatsworth.

2.09 PLYWOOD BOARDS IN TELECOMMUNICATION ROOMS

A. Plywood Backboard: Backboards shall be installed in each TR and the MTR on walls to a height of 8' AFF or as shown on the drawings. Rooms shall have walls covered as shown on the drawings

B. Acceptable options for plywood boards are:

1. ¾" AC Grade plywood painted with two coats of fire retardant paint in both sides and on the edges.
2. Pre-manufactured plywood system for telecommunications such as ReadySpec by Pathways and Spaces Inc.

C. Other specifications:

1. All imperfections and voids shall be filled, sealed and sanded prior to being primed and painted.
2. Fire retardant coating shall be tested to UL723, "Test for surface burning characteristics of building materials."
3. Paint color shall be grey, white or blue.
4. Fire retardant plywood shall be clearly labeled with the name of the Backboard Manufacturer, UL Classification of the Fire Retardant Coating, NFPA 255 Coating Flame Spread Index Class and the APA Grade of the plywood.
5. Plywood shall be installed with best side out.

2.10 THROUGH WALL/FLOOR FITTING FIRE STOP SYSTEM

A. General. These devices covered under this specification are firestop devices for use in through-penetration firestop systems, which are used to maintain the fire rating of the wall or floor, as well as to route and protect power and/or communications cable distribution for commercial, educational, healthcare, government, institutional, industrial and utility needs.

B. Classification and use: The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814) and bear the U.S. and Canadian UL Classification Mark. The device shall be classified for use in one-, two-, three-, and four-hour rated gypsum, concrete and block walls and provide a maximum L rating of 3.3 cfm. The device shall be classified for use in one-, two-, and three-hour rated concrete floors having a minimum 4 1/2" (114mm) thick reinforced lightweight or normal weight (100-150 pcf) (1600-2400 kg/m3). The devices shall also been tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

C. Materials:

1. Box: The fire stop device box shall be constructed of 16 gage G90 steel.
2. Intumescent block: The fire stop device intumescent block shall be constructed of a graphite base material with expansion starting at 375º F and an unrestrained expansion between 6 to 12 times. The intumescent block shall be held securely by the box in order to prevent tampering and damage during installation.
3. Adjustable doors: the fire stop device shall have doors or other system which can be adjusted to prevent materials from penetrating the device if the device is empty or completely full. The doors shall be constructed of 16 gage G90 steel with no. 10-32 screws use to adjust opening size.
4. Heat shield: For retrofit applications where an existing in-wall conduit extends out from the wall more than 7/8" [22mm], a UL listed Heat Shield must be used in order to maintain UL Fire Classification. The firestop device is then installed onto the heat shield
5. Split conduit and wall plate: For retrofit applications where no conduit is installed in the wall to protect existing cables, a split conduit assembly should be used to protect cables. After installing the split conduit within the wall, a wall plate should be installed to cover any irregularly shaped hole cut in the wall. The firestop device is then installed onto the conduit.

D. Sizes: the fire stop device shall be available for two (2) inch and four (4) inch trade size emt conduit.

E. Finish: the fire stop device shall be available in safety yellow or orange powder coat, custom colors and an unpainted galvanized finish.

F. Design selection: Wiremold FlameStopper, STI EZpath or approved equal

2.11 INNERDUCT (REGULAR)

A. Flexible raceway system also referenced in the design documents as regular innerduct or innerduct shall be provided in locations indicated in design drawings. The innerduct type shall be selected according to the environment where it will be installed, use HDPE innerduct only outdoors, use plenum or riser rated innerduct indoors. The installer is responsible for determining the proper selecting of the innerduct when used in air handling spaces. If at the time of bidding the installer is not sure what kind of environment is present in the project, the installer shall price plenum rated materials.

B. For plenum rated applications, the specifications of the innerduct shall be:

1. Material: White or orange Kynar PVDF Resin, a fluoropolymer compound.
2. Listing: Innerduct shall be listed to UL 2024, listing shall be printed in the product.
3. Marking: Footage shall be sequentially marked.
4. Configuration: corrugated type.
5. Pull line: built in 900 lb rated tape.
6. Size: Shall be available in ¾” through 2” diameters.

C. For riser rated applications, the specifications of the innerduct shall be:

1. Material: Orange polyvinyl chloride (PVC).
2. Listing: Innerduct shall be listed to UL 2024, listing shall be printed in the product.
3. Marking: Footage shall be sequentially marked.
4. Configuration: corrugated type.
5. Pull line: built in 900 lb rated tape.
6. Size: Shall be available in ¾” through 2” diameters.

D. For outdoor applications, the specifications of the innerduct shall be:

1. Material: High Density Polyethylene (HDPE).
2. Listing: None.
3. Marking: Footage shall be sequentially marked.
4. Configuration: corrugated type.
5. Pull line: built in 1,800 lb rated tape.
6. Size: Shall be available in ¾” through 2” diameters.

E. All inner ducts shall be provided with couplings and accessories suitable for the environment where they will be installed.

F. Design selection: products by Carlon or approved equal.

2.12 INNERDUCT (FABRIC TYPE)

A. When indicated in the design drawings, high capacity innerduct made of fabric shall be used inside telecommunication raceways to facilitate the pulling of telecommunication wires in those raceways. The fabric type Innerduct (also referenced as textile innerduct) shall have the following specifications:

1. Material: White Polyester and Nylon resin polymer
2. Standard Outdoor Textile Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape.
3. Indoor Textile Innerduct (Riser-listed): Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell nylon textile innerduct containing 1250lb polyester flat woven pull tape which meets UL2024A for flame propagation and smoke density values for general applications.
4. Plenum-Listed Textile Innerduct: Micro (33mm), 2-inch and 3-inch single or multi-cell nylon textile innerduct containing 200lb nylon-resin flat woven pull tape which meets UL2024A for flame propagation and smoke density values for use in air handling spaces.

B. The installer is responsible for determining the proper selecting of the innerduct when used in air handling spaces. If at the time of bidding the installer is not sure what kind of environment is present in the project, the installer shall price plenum rated materials.

C. Design selection: Products manufacturer by The Maxcell Group or approved equal. Approved equal shall be only of the fabric type innerduct.

2.13 DETECTABLE TAPE

A. A detectable tape shall be installed above all underground conduit at a minimum depth of 18” or as shown on the drawings. The detectable warning tapes shall be constructed with a solid aluminum foil core with a minimum thickness of 5 mils and 3” wide. The detectable warning shall have printed diagonal warning stripes conform to APWA color recommendations and bold, black legends identify what type of utility line is buried below. All detectable tapes used for this shall be labeled “fiber optics buried below”.

B. Design selection: Detectable tape from Carlon, Stranco, Ind., Terra Tape or approved equal.

2.14 COMMUNICATIONS VAULT (POLYMER CONCRETE)

A. In ground communication boxes also referenced in this document as communications vaults (polymer concrete) shall have the following specifications:

1. Construction Material: Precast Polymer Concrete.
2. Listing: UL listed enclosure, tested to ANSI/SCTE 77
3. Box vertical design load: 22,500 lbs.
4. Box vertical test load: 33,750 lbs.
5. Box lateral design load: 800 lbs/sq. ft.
6. Box lateral test load: 1,200 lbs/sq. ft.
7. Box dimensions: as indicated in design drawings.
8. Box bottom: open bottom
9. Holes for conduit: holes for conduit shall be cut at the factory and shall not cover more than 25% of the side of the enclosure. All sides of the box shall have holes for conduits, even though conduits might not be shown for all sides in the floor plans. No less than two holes for standard 4” conduit shall be at all sides. All unused holes shall be plug with plastic caps.
10. Cover ANSI TIER: 22
11. Cover logo: “Communications”
12. Cover screws: two (2) tamper resistant penta head screws
13. Cover accessories: two (2) 7” long cover hooks made of electroplated steel.

B. Design selection: Hubell Quazite PG style box with HH series cover and accessories or approved equal. Approved equals shall comply with all specifications listed above including construction material.

2.15 COMMUNICATIONS VAULT (PRECAST CONCRETE)

A. In ground communication boxes also referenced in this document as communications vaults (precast concrete) shall have the following specifications:

1. Construction Material: concrete 5000 psi @ 28 days

2. Rebar: ASTM A 615 grade 60 rebar
3. Mesh: Welded wire fabric ASTM A185 grade 65
4. Size: As indicated in design drawings
5. Design: comply with local building code for reinforced concrete
6. Loads:
    a. Dead load:
        1) concrete 150 PCF
        2) Earth cover – 120 PCF
        3) Lateral Earth pressure on walls:
            a) Equivalent fluid pressure above water table + 36 PSF per foot of depth.
            b) Equivalent fluid pressure below water table + 81.4 PSF per foot of depth.
    b. Live load:
        1) AASHTO HS20-44. 32,000 lbs. rear axle loading.

B. The cover and frame for the communications vault shall have the following specifications:

1. Style: Hatch type concrete lid
2. Cover design (for hatch type or galvanized cover): Hot dip galvanized after fabrication built to an H20 rating for non roadway applications with dual doors.
3. Cover design (for concrete lid with ring): 30” diameter cast or ductile iron, built to an H20 rating up to 150 KIO.
4. Lettering: Covers shall be label as “Communications”

C. All communications vault shall be provided with the following accessories:

1. Embedded lifters made of galvanized steel
2. All communications vaults with a concrete lid and ring shall be provided with a grade ring or riser made of concrete to bring the cover up to grade level. Precast concrete grade rings and cones shall comply with ASTM C 478, except that the wall thickness shall be 6 inches minimum. Provide interlocking keyways on rings and cones. Provide cones with cast in place inserts for the vault frame.
3. Embedded pulling irons made or carbon steel galvanized.
4. Two lengths of embedded unistrut (galvanized) for bolting equipment on 2 opposite walls of the vault.

D. Precast vault construction shall be in the form of monolithic walls or horizontal wall sections. Do not use panel walls.

E. Minimum wall thickness shall be 6 inches. Design knockout wall panels to accommodate loading pressures defined above.

F. Design and construct vaults to be watertight when subjected to groundwater over the entire height of the vault.

G. Provide openings in precast vaults for piping and access. Provide cast in place inserts in the roof slab and end walls at the locations as shown on the Drawings. No field coring of openings is allowed.

H. When communications vault are made of different sections, they shall be sealed and bonded with a double layer of plastic sealing compound and make watertight. Plastic sealing compound shall comply with Federal Specification SS-S-00210. Fill with mortar all recesses, lifting inserts, or other cavities not filled with plastic sealing compound. Mortar shall comply with ASTM C 387, Type S.

2.16 CONDUIT WATERFALLS

A. All 4" EMT terminations with communication cable entering/exiting the conduit from a cable tray (or tubular runway) system and the vertical separation between raceways is larger than 7” shall be fitted with a device to control the bend radius of the communication cable to a minimum of a 4" radius. The device to control the bend radius shall be called a conduit waterfall and must comply with all National Electrical Code requirements and TIA/EIA Standards. In addition, the product must be RoHS compliant to meet environmental requirements, be UL 94V-0 approved to reduce the spread of flame, and be approved by UL for use in air handling spaces. The device to provide bend radius control must support a static load of 40 lbs. (177.9 N) and have a fastening device that allows for incremental adjustments to conform to variances in conduit diameters.

B. Device quantities are not indicated in the drawings but the PS-SCS shall use all 4” conduits and sleeves indicated in the drawings to estimate the quantities of waterfalls to be used in the project.

C. Basis of design: Panduit CWF 400 or approved equal.

2.17 FIRE STOP SYSTEMS (FOR SMALL PENETRATIONS)

A. General: Fire stop system shall be selected by the PS-SCS installer as to comply with the following requirements:

1. Selected system shall be UL listed for the condition on which it will be installed. These conditions include: wall/slab type (masonry, drywall, etc), hour rating, and accessibility type.

B. Acceptable systems: caulk based products or firestop grommets by STI or equal.

2.18 EXPANSION FITTINGS

A. Installation: Provide expansion fittings in each conduit run wherever it crosses an expansion joint. Install the fitting on one side of the joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints.

B. Location: Provide expansion fittings in each conduit run which is mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other.

C. Length: Provide expansion fittings in straight conduit runs above ground which are more than one hundred (100) feet long.

PART 3: EXECUTION

3.01 INSTALLATION PRACTICES

A. See additional requirements indicated in part 3 of specification section 270010.

3.02 INDOOR CONDUITS BELOW GRADE AND ABOVE GRADE

A. BEND RADIUS. Conduits shall utilize long radius sweeps at all 90 degree transitions. The inside radius of a bend in conduit shall be at least six (6) times the internal diameter. When the conduit size is greater than two (2) inches, the inside radius shall be at least ten (10) times the internal diameter of the conduit. For fiber optic cable, the inside radius of a bend shall always be at least ten (10) times the internal diameter of the conduit

B. MAXIMUM DISTANCE BETWEEN JBOXES. For indoor installation no section of conduit shall be longer than one hundred (100) ft or contain more than two (2) 90 degree bends between pull points or pull boxes are required. For outdoor installation no section of conduit shall be longer than six hundred (600) ft. or contain more than two 90 degree bends between pull points or pull boxes are required.

C. LABELING. All indoor conduits 2” or larger shall be labeled at both ends when these conduit runs are continuous between two rooms and going through multiple walls or slabs. Labeling materials shall be as indicated in specification section 270010. Conduit sleeves 2” or larger penetrating just one wall is not required to be labeled.

D. PULL STRINGS; All conduits for technology systems shall be installed with pull strings.

3.03 UNDERGROUND TELECOMMUNICATIONS DUCT LINES

A. Description: Underground duct lines shall be of individual conduits. Conduits shall be encased in concrete where indicated on the plan drawings and duct bank sections. The conduit shall be of plastic, PVC Schedule 40, unless indicated or specified otherwise. The conduit used shall not be smaller than four (4) inches in diameter, inside, unless otherwise noted on the drawings.

B. Duct lines shall have a continuous slope downward toward communication vaults and away from buildings with a pitch of not less than 0.125 inches per foot. Changes in direction of runs exceeding a total of ten (10) degrees either vertical or horizontal shall be accomplished by long sweep bends having a minimum radius of curvature of twenty five (25) feet, except that manufactured bends may be made up on one or more curved or straightened sections or combinations thereof. Manufactured bends shall have a minimum radius of forty eight (48) inches.

C. Conduits. Conduits shall terminate in end-bells where duct lines enter manholes or communications vaults. Provide four (4) to six (6) inch reducers as required. Separators shall be of pre-cast concrete, high impact polystyrene, steel or any combination of these. The joints of the conduits shall be staggered by rows so as to provide a duct line having the maximum strength. During construction partially complete duct lines shall be protected from the entrance of debris, such as mud, sand and dirt by means of suitable conduit plugs. As the duct line is completed, a testing mandrel not less than 13 inches long with a diameter 1/4 inch less than the size of the stiff bristles shall be drawn through until the conduit is clear of all particles of earth, sand or gravel; conduit plug shall then be immediately installed.

D. Conduit. Plastic conduit, fittings and joints shall not have been stored in the sun or weather, in any excessively heated space, or unevenly supported during storage. Use and installation shall be in accordance with the National Electrical Code requirements for the installation of non-metallic rigid conduit. Plastic conduit shall be protected against the direct rays of the sun prior to installation. Conduit shall be Carlon Type EB, Queen City Plastics, or accepted substitution. Conduit shall be U.L. listed and conform to NEMA Standard TC6 1972.

E. Trench: Trenches for duct banks shall be completely dry before setting conduits or pouring concrete. Well pointing as required shall be provided if necessary to keep trench dry.

F. Excavation: Backfilling shall be in layers not more than eight (8) inches deep, and shall be thoroughly tamped. The first layer shall be earth or sand, free from particles that would be retained on a 1/4 inch sieve. The succeeding layers shall be excavated material having stones no larger than would pass through a four (4) inch ring. The backfill shall be level with adjacent surface, except that in sodded or paved areas, a space equal to the thickness of the sod or paving shall be left.

G. Finish: The surface disturbed during the installation of duct shall be restored to its original elevation and condition if not refinished in connection with site work.

H. Plugging: All unused conduit openings shall be plugged or capped with a suitable device designed for the purpose; caulking compound shall not be used for plugging conduit openings.

I. Stubs: Spare conduit stubs shall be capped and marked in the field and accurately dimensioned on the as-built drawings.

J. Spacers: All conduit run underground, or stubbed above floor shall be separated with plastic interlocking spacers manufactured specifically for this purpose, or shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel.

K. Minimum burial depth: All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with Section 300 5 of the NEC except that the minimum cover for any conduit or duct bank shall be two (2) feet, unless otherwise indicated.

L. Directional boring. For all applications requiring directional boring the following installation practices shall be followed.

1. The installer shall select the directional boring equipment based on the length of the pulls, soil conditions, pipe size, and pipe quantities.
2. When multiple pipes are run, each pipe shall be a different color.
3. Any pipe run less than 1,500 ft, shall be run as a single pull without splices.
4. Any splices done to HDPE pipes shall be done with manufacturer's approved methods.

3.04 INSTALLATION OF COMMUNICATIONS VAULTS

A. Excavating and backfilling for vaults. Perform earthwork as specified in Division 2. Provide 6-inch minimum thickness 3/4-inch crushed rock over the full width of the vault base and extend 12 inches beyond the edges of the vault. After repairing the waterproofing, backfill and compact around the vault with structural backfill material. Excavated material may be used for structural backfill provided it conforms to the Standard Specifications for structural backfill material.

B. Installing vaults and risers. Set each concrete vault section or riser plumb on a double layer bed of sealant at least 1/2-inch thick to make a watertight joint with the preceding unit. Point the inside joint and wipe off the excess sealant.

C. Waterproofing. Waterproofing shall be factory applied to all exterior surfaces of vaults and risers. This includes the bottom of the vault to be coated as an exterior surface. Apply two coats at a rate of 65 square feet per gallon per coat. Prior to backfilling, field apply waterproofing material on joints and damaged surfaces. Protect coating from damage during backfilling and compacting.

3.05 CUTTING AND PATCHING

A. Core Drilling: The installer shall be responsible for all core drilling as required for work under this section, but in no case shall the installer cut into or weld onto any structural element of the project without the written approval of the A&E. Any post tension slabs or slabs with embedded electrical raceways shall be X-rayed prior to coring by the installer.

B. Cutting and Patching: All cutting, rough patching and finish patching shall be provided as specified in the contract documents. All cutting and patching shall be performed in a neat and workmanlike manner.

C. Openings and Sleeves: Locate all openings required for work performed under this section. Provide sleeves, guards or other accepted methods to allow passage of items installed under this section.

D. Roof Penetration: All roof penetrations for raceways part of technology systems shall be approved by A&E prior to executing this work. All roof penetrations shall be as accepted by the roof manufacturer.

3.06 IDENTIFICATION OF BOXES

A. Tags: During installation of pull strings all pull strings shall be marked with waterproof vinyl tags indicating where the opposite end may be found.

3.07 BLANK PLATES

A. Plates: Unless otherwise noted all unused outlet boxes shall receive blank plates matching the finish of plates for electrical devices in the same room.

3.08 RACEWAY INSTALLATION

A. SUPPORT. All raceways shall be run in a neat and workmanlike manner and shall be properly supported and in accordance with the latest edition of the NEC code and BICSI guidelines. Supporting conduit and boxes with wire is not acceptable. Exposed raceways where allowed, shall be supported with clamp fasteners with toggle bolt on hollow walls, and with no lead expansion shields on masonry. All conduits shall be securely fastened in place with at least one support per eight foot section. Support within one foot of changes in direction. All required hangers, supports and fastenings shall be provided at each elbow and at no more than one foot from the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits shall not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.

B. HANGER INSTALLATION. Where two (2) or more conduits one (1) inch or larger run parallel, trapeze hangers may be used consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or approved clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.

C. NON-CONTINUOUS CABLE SUPPORTS INSTALLATION. When j-hooks are allowed in the project by this specification (See USE OF CONDUIT FOR DIFFERENT SYSTEMS) non-continuous cable supports (j-hooks) shall be installed only as recommended by manufacturer not exceeding the load ratings of the devices. Install non-continuous cable supports in spans no longer than 4’. Whenever there are changes in elevation additional supports shall be required to avoid having stress on cable or sharp bends.

D. FIRE STOPPING: For 4” sleeves, the PS-SCS installer shall provide through wall/floor fittings firestop system and for other smaller sleeves or wall penetrations through fire rated partitions the PS-SCS installer can use the same type of firestop system or a fire stop system for small penetrations in compliance with products described in part 2 of this specification.

E. PENETRATIONS IN FIRE RATED PARTITIONS. Installation of electrical boxes or equipment backboxes in fire rated walls and smoke barriers shall follow the following requirements:

1. Electrical boxes and or technology system backboxes can be installed in 1 or 2 hour rated walls as long as all requirements indicated in the proper Building Code, National Electrical Code and nationally recognized testing laboratories are met for this type of installation.
2. As a summary, some of the requirements indicated by the codes listed above are:
    a. Boxes shall be metallic or listed for that purpose
    b. The area of the boxes shall not exceed 16 square inches, provided the aggregate are of the openings through the membrane does not exceed 100 square inches in any 100 square feet of wall area.
    c. The spacing between the wall membrane and the box shall not exceed 1/8 of an inch.
    d. Boxes on opposite sides of the walls shall be separated by no less than 24 inches, or boxes shall be covered by listed putty pads, or a listed material and method used.

3. Electrical boxes or technology systems backboxes shall not be installed in a 3 or 4 hour fire rated rated walls.

F. ROUTING: Conduits shall be run parallel to building walls wherever possible, exposed or concealed as specified, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.

G. PROTECTION DURING CONSTRUCTION. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction until wires are pulled in and covers are in place. No conductors shall be pulled into raceways until the raceway system is clean and complete.

H. PROTECTIVE BUSHINGS: All un-terminated conduits shall have an insulated protective bushing to avoid cable damage at the edge of the conduit.

I. AVOIDING EMI: To avoid EMI for Telecommunications cabling and/or conduit containing cabling, all raceways shall provide clearances of at least four (4) feet (1.2 meters) from motors or transformers; one (1) foot (0.3 meter) from conduit and cables used for electrical-power distribution; and five (5) inches (12 centimeters) from fluorescent lighting. Raceways shall cross perpendicular to fluorescent lighting and electrical-power cables and conduits. The Installer shall not place any raceway alongside power lines

J. COORDINATION. All raceways shall be kept clear of mechanical equipment and plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

K. MASONARY INSTALLATION. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.

L. USE OF CONDUIT IN DIFFERENT AREAS. When low voltage cables (any technology system) have to be run above ground in a space with no type of accessible ceiling (interior or exterior), all cable runs shall be in conduit completely, continuing the raceways all the way to the nearest accessible ceiling (in the direction of the telecom closet) or grouping the raceways into a single larger diameter conduit with the same or larger cross sectional area than the sum of all the conduits coming into it. The use of j-hooks to support low voltage cables in areas with no ceiling or hard ceiling shall not be allowed. This type of condition is usually not indicated in the drawings because design drawings don't show conduits smaller than 2", nevertheless it shall be provided as indicated herein.

M. USE OF CONDUIT FOR DIFFERENT SYSTEMS: The following paragraphs indicate the design intent for raceways system for all technology systems.

1. For all systems under division 27 (with the exception of security systems and CCTV): Conduit stub up from the outlet to the nearest telecommunications room
2. For all systems under division 28 (security systems and CCTV): Conduit stub up from the outlet to the nearest telecommunications room.
3. Non-continuous support systems (J-hooks) are not allowed in this project as a horizontal support system for cables above ceilings.

3.09 CABLE TRAY INSTALLATION

A. Inspection: Examine area for clearances, to allow proper installation of the tray according to the routing indicated on the drawings. Check existing building steel and other supporting structures to establish the type of tray hangers to be used and at the proper spans.

B. Installation Criteria: Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that cable tray equipment comply with requirements of NEC and applicable portions of NFPA 70B. Reference NEMA-VE2 for general cable tray installation guidelines

C. Support: Cable tray support shall be by means of welded angle brackets to structural components, brackets shall be as manufactured by the Cable tray manufacturer. Complete straight section of cable tray shall have at least 1 support at a ¼ of the length of the section. Additional supports are required at tray ends, offsets, bends and changes of elevation.

D. Grounding: All conduits terminating within 12 inches of a cable tray shall be bonded with a grounded in accordance with the National Electric Code.

E. Coordination: Wherever possible, install horizontal cable trays above water and steam piping. Coordinate installation of tray with other trades for clearances, to avoid conflicts. A minimum of 300 mm (12 in) access headroom shall be provided and maintained above the cable tray system or cable runway. A minimum of 150 mm (6 in) access headroom shall be provided and maintained at both sides (one side if tray is supported at the wall. Care shall be taken to ensure that other building components (e.g., air conditioning ducts, pipes, structural elements) do not restrict access. The cable tray must be installed with at least 75mm (3 in) of clear vertical space above the ceiling tiles and support channels (T-bars) to ensure accessibility. When crossing other building components with the cable tray or runway the above specified clearances shall be maintained.

3.10 RUNWAY CABLE TRAY SYSTEM INSTALLATION

A. General. Runway cable tray system shall be installed following manufacturer's recommendations for installation.

B. Support locations: supports shall be provided as recommended by the manufacturer, but as a minimum supports shall be located as follows:

1. Before each 90 deg turn.
2. No continuous section shall have more than 3ft of span without a support.
3. At each 2-post rack or 4-post rack
4. At each change in elevation

C. Support type. When runway cable tray is to be installed against the wall, the only support type to be used is a wall bracket supporting from the bottom of the tray. For sections of runway cable tray to be installed over racks, the preferred support system is to the racks themselves. Trapeze style support brackets shall only be used when no other method of support is possible. Center hung support systems shall never be used.

D. Vertical runways. Runway cable tray system shall be installed continuously vertically in all telecommunications rooms in the project from sleeves coming from the ground (or floor below) to the sleeves going to the floor above, whether or not indicated in the drawings. The runway installed shall have the same width as the total width of the sleeves coming into the telecommunications room, although multiple sections installed together are acceptable. If the sleeves from the floor below to the floor above don't line up in a straight line, two vertical sections are accepted, one to the horizontal runway cable tray and one from the horizontal runway cable tray to the sleeves above. Runway cable trays installed vertically shall have supports to the floor, wall and slab above.

E. Cable dropout. At each rack or cabinet that has runway cable tray system running on top of it, a cable dropout shall be installed to protect the bend radii of the cable. This dropout accessory shall have a bend radius of no less than 4".

F. Bonding. Any two continuous sections of runway cable tray system shall be bonded together with a #1 bonding jumper (600A) 15" long. All bonding jumpers shall be made of steel with yellow, zinc-dichromate finish. All fasteners shall be made of steel with zinc-plated finish

G. Protective end caps. All end sections of runway cable tray sections shall be protected with plastic protective end caps.

3.11 INSTALLATION OF INNERDUCT

A. Protect products from the effects of moisture, UV exposure, corrosion and physical damage during construction.

B. When inner duct is laid on a cable tray, it shall be strapped to cable tray with nylon ty-wraps at periodic intervals of no less than 4 ft.

C. When multiple inner duct are in a single conduit, and innerduct are of the same size, they shall be different colors for identification or have different color electrical taped wrapped on the ends to identify them at the end of each conduit.

3.12 AS BUILT DOCUMENTS AND CLOSE OUT INFORMATION

A. See specification section 270010 for as built documents and close out information these requirements.

END OF SECTION 27 05 28

SECTION 27 10 00
STRUCTURED CABLING SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

A. General: Telecommunications Drawings apply to work of this section. The overall and detailed Structured Cabling System (SCS) design shown on the drawings, selected materials, device locations, installation details, mounting details, cabling routing and supporting and all technical specifications if provided on the drawings apply to work of this section.

B. General: Furnish, install, test and certify complete with all accessories an ANSI/TIA 568C SCS with a minimum 25 year performance warranty for the entire system from the manufacturers and a minimum of 3 years warranty for materials and labor from the SCS installer for all components not covered under the manufacturer's 25 year warranty. The goal of the project is to provide an enhanced SCS that shall serve as a vehicle for the transport of voice telephony, data, audio, video, security and low voltage devices for building controls and management, throughout the building and from building to building from designated demarcation points to outlets located at various desk, workstation and other locations as indicated in the contract drawings.

C. Coordination with other trades: It is the responsibility of the installer of the SCS to verify and advice the installer of the raceway infrastructure (conduit, boxes, cable tray, in ground boxes, etc) for this system on raceway routing to minimize the wiring distances to the telecommunication room. When J-hooks are acceptable for the use in structured cabling system, all J-hooks and supports for these devices shall be in the scope of work of the SCS installer.

D. All patching and cross connect to owner provided equipment shall be included under the scope of work of this project.

E. WAP installation. The scope of work includes the installation of the Wireless Access Points (WAPs) provided by the owner. The scope includes the labor and installation materials (supports, anchors, etc.) to properly fasten the WAPs to the structure.

1.02 RELATED DOCUMENTS

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

B. Supplemental: Refer to the specification sections identified below for additional requirements, which are supplemented by this section:

Section	Title
270010	TECHNOLOGY GENERAL PROVISIONS
270528	RACEWAYS FOR TECHNOLOGY
270526	GROUNDING & BONDING FOR TELECOMMUNICATIONS SYSTEMS

C. Owner standards: Comply with the document "Requirements for all Communication Cabling at Clients name" prepared by the Clients applicable office.

D. Standards: All work related to the SCS shall be in compliance with the following industry codes and standards latest edition:

1. ANSI/TIA-568.0-D "Generic Telecommunications Cabling for Customer Premises" with addendums and errata.
2. ANSI/TIA-568.1-D, "Commercial Building Telecommunications Cabling Standard" with addendums and errata.
3. ANSI/TIA-568-C.2, "Balanced Twisted- Pair Cabling Components Standard" with addendums and errata.
4. ANSI/TIA-568.3-D, "Optical Fiber Cabling Component Standard" with addendums and errata.
5. ANSI/TIA-569-D, "Telecommunications Pathways and Spaces" with addendums and errata.
6. ANSI/TIA-606-C, "Administration Standard for Telecommunications Infrastructure" with addendum and errata.
7. ANSI/TIA-607-C, "Generic Telecommunications Bonding and Grounding (earthing) for Customer Premises" with addendum and errata.
8. ANSI/NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.
9. ANSI/TIA 758-B, "Customer-Owned Outside Plant Telecommunications Infrastructure Standard" with addendum and errata

10. ANSI/TIA 862-B, “Structured Cabling Infrastructure Standard for Intelligent Building Systems” with addendum and errata.
11. ANSI/TIA-1152-A, “Requirements for Field Test Instruments and Measurement for Balanced Twisted Pair Cabling” with addendum and errata.
12. ANSI/TIA-526-7-A, “Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant”.
13. ANSI/TIA-526-14-C, “Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant”.
14. TIA-598-C, Optical Fiber Cable color coding. .
15. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments. “Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling”
16. ANSI/TIA-942-B, “Telecommunications Infrastructure Standard for Data Centers” with addendum and errata
17. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
18. ANSI/NFPA 70 “National Electrical Code”, CSA C22.1.
19. BICSI Telecommunications Distribution Methods Manual (TDMM)
20. BICSI Telecommunications Cabling Installation Manual (TCIM)
21. BICSI Customer Owned Outside Plant Manual (COOPM)
22. Local County/City Codes, Ordinances and Regulations.
23. Underwriters Laboratories (UL)
24. FCC -Federal Communications Commission
25. ADA Requirements
26. Occupational Safety and Health Regulations (OSHA)
27. National Fire Protection Association (NFPA)
28. ANSI/TIA-1179, Healthcare Facility Telecommunications Infrastructure Standards
29. Manufacturers Product Cabling Catalogs
30. Manufacturers Training Manuals (Design and Installation).

E. General: Installation practices for SCS as describe herein take precedence over any other section in the construction documents set.

1.03 STRUCTURED CABLING SYSTEM INSTALLER QUALIFICATIONS

A. **All network infrastructure will utilize the districts preferred vendors”**

1. **CPS for all cable, LAN fiber, cabinets, etc.**
2. **Crown Castle for WAN fiber.**
3. **PDS for network switches and access points.**

B. General: The installer selected for the project must be certified by the manufacturers of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturers components and distribution channels in provisioning the Project.

C. General: The installer directly responsible for this work shall be a Structured Cabling System (SCS) Installer who is, and who has been, regularly engaged in the providing and installation of commercial and industrial telecommunications wiring systems of this type and size for at least the immediate past five years. Any other company working for the SCS installer of this system shall have the same training and certification as the SCS installer.

D. Certification: The SCS installer’s Project Manager shall possess a current and in Good Standings BICSI Registered Communications Distribution Designer (RCDD®) certificate. All shop drawings submitted by the SCS Installer shall bear the RCDD's stamp.

E. The SCS Installer shall have a (BICSI) RCDD on Staff. Third party RCDD’s shall not be acceptable.

F. The Installer team leader assigned for the project shall be BICSI registered Level II installer or proven and qualified equal.

G. Experience: The SCS Installer shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The SCS Installer shall own and maintain tools and equipment necessary for successful installation and testing of SCS and have personnel who are adequately trained in the use of such tools and equipment. The Owner or engineer may elect to request submittal of additional financial, operational and administrative information of the SCS installer to demonstrate the required experience.

H. The SCS Installer shall possess a State Low Voltage License.

I. The SCS Installer shall maintain a permanent office within 150 miles of the project site.

1.04 MATERIALS ALTERNATES AND SUBSTITUTIONS

A. SCS Installer shall follow all requirements for materials alternates and substitutions indicated in specification section 270010.

B. Substitutions are only allowed for the SCS when the substitutions do not change the warranty of the SCS system as indicated in this specification section

1.05 SHOP DRAWINGS AND SUBMITTALS.

A. See additional requirements for shop drawings and submittals in specification section 270010.

B. Proposal Submittals: The SCS Installer shall submit the following information with the proposal to execute the work:

1. A list of five (5) recently completed projects of similar type and size with contact names and telephone numbers for each.
2. A list of test equipment proposed for use in verifying the integrity of the installed SCS. Test equipment list shall include manufacturer part number, serial numbers and a copy of the last calibration report done by the manufacturer of the equipment of the unit, indicating the date when the calibration was done. Calibrations shall not be older than one year. Test equipment includes, cable certifiers, OTDRs, fiber splicers, etc.
3. A technical resume of experience for the installer's engineer/RCDD and on-site foreman who will be assigned to the project, including RCDD license number.
4. Similar documentation for any company working for the SCS Installers who will assist in the performance of this work.
5. A copy of a current and valid Low voltage License
6. Location of office from which installation and warranty work will be performed.

C. Construction submittals: Once all proposal submittals have been received and approved by the Architect and Engineer (A&E) of the project, the SCS Installer shall provide all construction submittals. Construction submittals are composed of the following items.

1. Manufacturer's cut sheets for all proposed equipment as described in Part 2 of this specification section. Cut sheets shall bear the printed logo or trademark of the manufacturer for each type of product being provided. Mark each copy of the cut sheets for the specific product being provided with an identifying mark, arrow, or highlighting.
2. Faceplate color selection.
3. Detail explanation of the labeling scheme to be used for all components of the system. This explanation shall include examples of all types of labels to be used, like labels for cables, patch panels, outlet jacks, etc.
4. Autocad® or Revit drawings in sheets matching the size of the design documents with the following information:
    a. Floor plans with all outlets in the project. All outlets shall have the label to be used during identification and tagging process described in this specification section.
    b. Enlarged telecommunication rooms with all equipment components and rack layouts for each room. All racks shall have the label to be used during identification and tagging process described in this specification section.
    c. Drawings indicating rack elevations for all cabinets or racks in the project, identifying the precise quantity of patch panels, fiber distribution centers and wire managers and accurate RU heights based on equipment selection. All equipment shall have the label to be used during the identification and tagging process described in this specification section.
    d. A spreadsheet indicating all patch cords (fiber and copper) to be provided in the project. The spreadsheet shall indicate the quantity, color of the jacket, cable type, length and connector termination on each side.

D. Construction submittals received before proposal submittals are received or approved will be rejected.

1.06 ABBREVIATIONS

A. General: The following abbreviations are used in this specification section:

1. A&E - Architect and Engineer. The Architect is the legal entity that holds a contract for the design the project. The Engineer is the consulting engineer firm or engineer of record for the project who prepared this specification.
2. APC - Angle physical contact connector. Reference to the polish style of the ferrule in fiber optic connectors.
3. Array connector - a multi-strand fiber connector user for high density applications, such as the MPO connector
4. BICSI - Building Industry Consultant Services International
5. CCTV - Close circuit television system (surveillance video system)

6. FCC - Federal Communications Commission.
7. FTP - Foiled Twisted pair. One foiled screen around each cable pair.
8. IDC - Insulation Displacement Connector
9. NEC - National Electrical Code.®
10. NEMA - National Electrical Manufacturers Association.
11. OM1 - ISO 11801 designation for multimode 62.5/125µm glass fiber optics.
12. OM2 - ISO 11801 designation for multimode 50/125µm glass fiber optics.
13. OM3 - ISO 11801 designation for multimode laser optimized 50/125µm glass fiber optics.
14. OM4 - TIA designation for multimode laser optimized 50/125µm glass fiber optics in compliance with TIA-492-AAAD.
15. OS1 - ISO 11801 designation for single mode 9/125µm glass fiber optics.
16. OS2 - ISO 11801 designation for single mode 9/125µm glass fiber optic with performance criteria identical to ITU-T G652.
17. OTDR - Optical Time Domain Reflectometer.
18. RU - Rack units. Height dimension for rack mounted equipment. 1 RU equivalent to 1.75".
19. SCS - Structured Cabling System
20. ScTP - Screened twisted pair. One foiled screen around all cable pairs
21. TIA - Telecommunications Industry Association.
22. TR - Telecommunications Room.
23. UPC - Ultra physical contact connector. Reference to the polish style of the ferrule in fiber optic connectors.
24. UTP - Unshielded twisted Pair
25. UV - Ultra violet
26. VAC - Volts alternating current.

PART 2: PRODUCTS

2.01 MODULAR SCS JACKS

A. Structured cabling system outlets indicated in design drawings are composed of modular SCS jacks, mounted in a faceplate on an electrical box. Modular SCS jacks shall be 8-pin modules (RJ-45) that meet or exceed the following electrical and mechanical specifications:

1. Electrical Specifications:
    a. Insulation resistance: 500 MΩ minimum.
    b. Dielectric withstand voltage 1,000 VAC RMS, 60 Hz minimum, contact-to-contact and 1,500 VAC RMS, 60 Hz minimum from any contact to exposed conductive surface.
    c. Contact resistance: 20 M Ω maximum.
    d. Current rating: 1.5 A at 68 º F (20 º C) per IEC publication 512-3, Test 5b
    e. ISO 9001 Certified Manufacturer
    f. UL verified for EIA/TIA electrical performance
    g. Comply with FCC Part 68
    h. Cable termination: IDC type universal T568A or T568B.
2. Mechanical Performance:
    a. Plug Insertion Life: 750 insertions
    b. Contact Force: 3.5 oz (99.2 g) minimum using FCC-Approved modular plug.
    c. Plug Retention Force: 30 lb (133 N) minimum between modular plug and jack.
    d. Temperature Range: -40º to 150ºF (-40 º to 66 º C)

B. Design selection: modular SCS jacks shall be selected according to the following criteria:

1. Performance requirement:***CAT6***
2. Style: Rear loading
3. Mounting orientation: straight mounting
4. Color: To match owner's standards
5. Dust cover required: No

C. Approved manufacturer: Panduit, CommScope, Belden.

2.02 FIELD TERMINATABLE 8 POSITION MODULAR PLUG

A. When indicated in the design drawings to use Direct Attach connection for any field devices, field terminatable 8 positions modular plugs shall be used. This device shall be 8-pin modules (RJ-45) plugs that meet or exceed the following electrical and mechanical specifications:

1. General Specifications:

    a. Shall include an IDC type of termination for the cable. Crimp type terminations not acceptable.
    b. Shall support cable gauges from 22 to 26 AWG
    c. Shall include a rubber boot

2. Electrical Specifications:

    a. ISO 9001 Certified Manufacturer
    b. UL verified for EIA/TIA electrical performance
    c. Comply with FCC Part 68
    d. Cable termination: IDC type universal T568A or T568B.

B. Design selection: modular SCS jacks shall be selected according to the following criteria:

1. Performance requirement: Match performance of Modular SCS jacks

C. Approved manufacturer: Match selection for modular SCS jacks.

2.03 OTHER MODULAR JACKS

A. Whenever indicated in the design drawings SCS outlets could have terminations for other media types like fiber optic cables, coaxial cables or audio cables. Whenever those type of media are identified in the drawings, the following specifications shall be meet for modular jacks mounted in SCS outlets:

1. Style, mounting orientation and color: match design selection for modular SCS jacks.
2. Broadband distribution system connector: Use modular jack with F connector bulkhead rated at 75Ω.
3. Fiber optic connectors: use modular jack with adapter plate for LC connector.
4. For line level audio signals: use modular jack with RCA connector bulkhead. Use different color coded insulators for different audio channels.

B. Approved manufacturer: Match selection for modular SCS jacks.

2.04 FACEPLATES

A. Faceplates shall be used for all flush mounted telecommunication outlets to house modular jacks. Faceplates shall have the following specifications:

1. Construction material: Stainless Steel.
2. Size: use single gang faceplates only unless specifically noted in the design drawings.
3. Capacity of modular jacks per faceplate: faceplate shall be selected as to accommodate the amount of cables in each telecommunication outlet. No more than one unused opening shall be present on each faceplate.
4. Color: submit color to A&E for approval.
5. Labels: faceplate shall have two (2) recesses for labels, top and bottom, and shall have transparent label snap-on covers.
6. Faceplate style: Direct modular plug rear loading style

B. All faceplates shall have a tamper resistant cover to access the modular jacks

C. Approved manufacturer: Match selection for modular SCS jacks.

2.05 FACEPLATES WITH SUPPORT STUDS

A. Telecommunication outlets indicated in the design drawings as to be wall mounted telephone outlets shall be composed of one modular SCS jack and one faceplate with support studs mounted on an electric box. Faceplates with support studs shall have the following specifications:

1. Construction material: Stainless Steel.
2. Size: use single gang faceplate with two support studs.
3. Capacity of modular jacks per faceplate: One.
4. Faceplate style: Direct modular plug rear loading style.

B. Approved manufacturer: Match selection for modular SCS jacks.

2.06 SURFACE MOUNTED BOXES

A. Telecommunication outlets indicated in the design drawings as to be surface mounted outlets shall be composed of modular jacks mounted in a surface mounted box inside an electrical enclosure. Surface mounted boxes shall have the following specifications:

1. Construction material: High impact thermo Plastic.
2. Capacity of modular jacks per surface mounted box: size of surface mounted box shall be selected as to accommodate the amount of cables in the surface mounted telecommunication outlet. No more than one unused opening shall be present on each box.
3. Color: White.
4. Labels: surface mounted boxes shall have at least one (1) recess for labels, and shall have transparent label snap-on covers

B. Approved manufacturer: Match selection for modular SCS jacks.

2.07 MOUNTING FRAMES

A. All telecommunication outlets shall be properly mounted in the electrical raceway system provided for the outlet. The SCS installer shall select the proper mounting frame and/or bezel to mount the modular plugs in the raceway system. Raceway systems include furniture systems, floor boxes, poke-thrus, power poles, surface raceways system, etc.

B. Whenever design drawings indicate a telecommunication outlet to be mounted in a furniture system the SCS Installer shall select the proper mounting frame to hold the modular jacks in the furniture system selected by the owner. Color of the mounting frames shall match the color of the furniture system.

C. If owner provided furniture system does not have a raceway system for telecommunication, and design drawings indicate outlet to be mounted in the furniture system, SCS installer shall provide a plastic surface mounted box that allows the mounting of the modular plugs in a standard telecommunication faceplate.

D. SCS installer shall provide all mounting frames and bezels to mount modular jacks inside floor boxes or poke-thrus.

E. All un-used ports in mounting frames shall be covered with blank inserts.

F. Approved manufacturer: Match selection for modular SCS jacks.

2.08 HORIZONTAL 4-PAIR CABLE

A. General: Horizontal 4-pair cables shall be extended between the telecommunications outlet location and its associated equipment inside the TR. The cable shall consist of 4 pair cable solid copper conductors, certified to the specified performance standard. All horizontal 4-pair cables shall be terminated in modular jacks and patch panels with IDC type connectors and shall have the following specifications:

1. Cable Gauge: minimum 23 AWG
2. Performance standard: TIA/EIA ***CAT6***
3. Cable type: UTP
4. Performance characterized to: 600 MHz
5. Time delay skew: Maximum 45 ns/100m
6. Input impedance (1-100MHz): 100**Ω**
7. Cable diameter: ≤ 0.295 inch

B. Performance verification: All performance of horizontal 4-pair cable shall be verified by a Nationally Recognized Testing Laboratory (NRTL) for EIA/TIA electrical performance and comply with FCC Part 68.

C. Jacket: Cable jacket for inside premise cables shall comply with Article 800 NEC for correct use in the environment in which they will be used. If at the moment of the bid the SCS installer does not know the environment, in which cables will be used, the SCS installer shall assume plenum rated is required for the project. At a minimum all cables shall have a flame retardant PVC jacket riser rated.

D. OSP Jackets: All horizontal 4-pair cables run in conduits below the floor slab shall have a water resistant flooding compound and a jacket made of UV resistant polyethylene. Cables with PVC jackets are not acceptable for this application.

E. Jacket marking: All horizontal 4-pair cables shall have at least two types of markings imprinted in the jacket, transmission performance marking and NEC rating for environment to be used.

F. Approved manufacturer: Belden, Panduit, CommScope General Cable, or Berk-Tek.

2.09 PATCH PANELS FOR HORIZONTAL CABLING

A. All 4-pair horizontal cables shall be terminated in rack mounted path panel located in the telecommunication rooms rack. These patch panels shall have the following specifications.

1. Connector type: Fillable patch panel with inserts.
2. Cable termination: IDC type universal T568A or T568B.
3. Performance requirement: CAT6
4. Maximum connectors per path panel allowed: 48
5. Patch panel type: rear loaded panels (use modular SCS jacks for all inserts)
6. Patch panel shape: straight (flat)
7. Permanent marking: All connectors shall be labeled in sequential numbers
8. Field labels: patch panels shall have a space for field labels covered with transparent protectors.
9. Shielding: use shielded patch panels only with ScTP cable.
10. Size: All patch panels for network drops shall be 48 port, 1 rack unit. Design selection: Panduit NKPP48HDY or approved equal matching modular jack

B. Approved manufacturers. Match selection for modular SCS jacks

2.10 HORIZONTAL WIRE MANAGERS

A. Horizontal wire managers shall be mounted in racks to route cables from patch panels to vertical wire managers and to equipment. Horizontal wire managers shall have the following specification:

1. Style: Finger duct style with hinged cover multiple rings finger duct style with removable cover
2. Sides: front of rack front and back of rack
3. Minimum height: two RU,

B. Approved manufacturers. Match selection for modular SCS jacks

2.11 CROSS OVER WIRE MANAGERS

A. Cross over wire managers shall be used to route patch cables from the right vertical wire manager to the left vertical wire manager or between racks. Cross over wire managers shall have the following specification:

1. Style: six port finger spacing with a cover
2. Sides: front of rack
3. Minimum height: Four RU

B. Approved manufacturers. Match selection for modular SCS jacks

2.12 FOUR (4) PAIR PATCH CORDS

A. Four (4) pair patch cords are required at the work area side and at the patch panel side to complete the connectivity path to the equipment. All 4-pair patch cords shall be factory tested and shall have molded boots to the cable jacket. Field made patch cords are not acceptable. Four pair patch cords shall have the following specifications:

1. Connectors: 8-pin modular plugs at both ends
2. Conductors: 4-pair stranded conductors.
3. Wire gauge: 23AWG for patch cords in the field site and 28 AWG for patch cords in the telecom room side
4. Wiring map: See section 3 of this specification
5. Performance requirement: To match horizontal 4-pair cable performance
6. Cable type: UTP [match horizontal cable selection]

B. Approved manufacturers. Match selection for modular SCS jacks

2.13 SINGLE STRAND FIBER OPTICS CONNECTORS

A. All fiber optic cables (horizontal or backbone cables) shall be terminated on fiber optic connectors at both ends of the cable with either single strand fiber optic connectors or array connectors. Single strand fiber optic connector shall be compliant with industry standard ANSI/TIA-568-C.3 and the applicable TIA/EIA Fiber Optic Connector Intermateability Standard (FOCIS) document, TIA/EIA 604 series. Single strand fiber optic connectors shall have the following specification:

1. Physical contact type: use UPC type connector for all application with the exception of applications of Broadband TV distribution systems or DAS systems. For those applications use APC type connectors.
2. Connector type: LC

3. Security level: non-keyed connector
4. Pairing style: duplex
5. Acceptable connector attachment types:
    a. Epoxy type connectors, field polished
    b. Epoxyless (Crimp) type connector, field polished.
    c. Splice on connectors. Fusion spliced connectors with factory polished finish.
    d. Fusion spliced pig tail with factory polished connector. Mechanical splices for pig tails are not acceptable.
6. Fiber type: SCS installer shall select the connector according to the fiber type where connector will be installed. As an example use OM1 connectors only in OM1 fiber optic cables.
7. Fusion spliced pig tails. When using fusion spliced pig tails the SCS installer shall make sure the fiber type of the pig tail and the actual cable have the same optical characteristics, such as back scatter, core diameter, etc.
8. Ferrule construction: use ceramic ferrule connectors only, plastic ferrules are not acceptable.

B. All single strand fiber optic connectors shall include boots to protect the fiber optic cable. The SCS installer shall select the boot according to the fiber optic type selected. As an example use 900µm boots in 900µm coated fiber, use 250µm boots on 250µm coated fiber and use 2mm boots on 2mm jacketed fiber. All boots shall be color coded to identify the type of fiber connector used. Boots shall be beige for OM1 fiber, black for OM2, aqua for OM3 and OM4 or green.

C. Single strand multimode fiber optic connectors shall have the following performance requirements:

1. The maximum insertion loss shall be 0.75 dB (maximum) when installed in accordance with the manufacturer's recommended procedure and tested in accordance with FOTP-171.
2. Connector reflectance shall be less than or equal to -26 dB when installed in accordance with the manufacturer's recommended procedure.
3. Connectors shall sustain a minimum of 500 mating cycles without violating specifications.
4. Connectors shall have an optical axial pull strength of 2.2 N (0.5lbf) at 90º angle, with a maximum 0.5dB increase in attenuation for both tests when tested in accordance with ANSI/EIA/TIA-455-6B.

D. Single strand single mode fiber optic connectors shall have the following performance requirements:

1. Maximum insertion loss shall be 0.75 dB per each mated connector pair when installed in accordance with the manufacturer's recommended procedure and tested in accordance with FOTP-171.
2. Connector reflectance shall be less than or equal to -40 dB (UPC) when installed in accordance with the manufacturer's recommended procedure.
3. Connectors shall sustain a minimum of 500 mating cycles without violating specifications.
4. Connectors shall have an optical axial pull strength of 2.2 N (0.5lbf) at 90º angle, with a maximum 0.5 dB increase in attenuation for both tests when tested in accordance with ANSI/EIA/TIA-455-6B.
5. Connectors shall meet the following performance criteria:

Test	Procedure	Maximum Attenuation Change (dB)
Cable Retention	FOTP-6	0.2dB
Durability	FOTP-21	0.2 dB
Impact	FOTP-2	0.2 dB
Thermal Shock	FOTP-3	0.2 dB
Humidity	FOTP-5	0.2 dB

E. Approved manufacturers. Ortronics, Corning, Belden, Panduit, Siemon, Leviton, CommScope or 3M

2.14 FIBER OPTICS SPLICES

A. When fiber splicing is required in the project because of the use of pigtails or field splicing, only fusion splicing will be acceptable. Mechanical splices shall not be used unless specifically indicated in the contract documents.

B. All fiber splices shall be terminated with heat shrink sleeves and organized in splice trays. Splice trays sizes shall be selected to match the quantity of fiber strands in the cable bundles. Splice trays shall be organized in Fiber Optics Distribution Centers when inside a telecom room or in outdoor rated splice closures when done outdoors.

C. Fusion splice equipment to be used in this project shall have the following specifications:

1. Alignment system: Automatic Core Detection system (ACD). V-groove splicers are not allowed.
2. Typical splice loss for single mode fibers: 0.02 dB

3. Splice loss result: Estimated (ACD) Measurement (LID)
4. Unit shall have a fast heat shrink oven, maintenance free electrodes, built in cleaver and graphical user interface to display alignment condition.
5. Cleaver blade type: diamond.

2.15 INSIDE PREMISE FIBER OPTICS HORIZONTAL CABLES

A. Telecommunications outlets could have fiber optic terminations. Whenever design drawings indicate fiber optic terminations, inside premise fiber optic horizontal cables shall be used. The following are the specifications for fiber optic horizontal cables:

1. Strand Count: as indicated in design drawings
2. Fiber type: OM3/OS1/OS2 as indicated in design drawings
3. Fiber coating: 900µm coating color coded
4. Fiber protection: aramid yarn
5. Jacket type: 2.9mm flame-retardant PVC jacket zip-cord type.
6. Color jacket: jacket shall be orange for OM1 or OM2 fiber, aqua for OM3 or OM4 fiber and yellow for OS1 or OS2 fiber.

B. Jacket: Cable jackets for fiber optic cables shall comply with Article 770 NEC for correct use in the environment in which they will be used. If at the moment of the bid the SCS installer does not know the environment, in which cables will be used, the SCS installer shall assume plenum rated is required for the project. At a minimum all cables shall have a flame retardant PVC jacket riser rated. Rating shall be printed in the cable jacket.

C. OSP Jackets: All fiber optic horizontal cables run in conduits below the floor slab shall have a water resistant flooding compound and a jacket made of UV resistant polyethylene. Cables with PVC jackets are not acceptable with this application.

D. Approved manufacturers. Match selection for horizontal 4-pair cable

2.16 INSIDE PREMISE FIBER OPTICS BACKBONE CABLES

A. Whenever design drawings indicate fiber optics backbone cables to be run inside premises, the following specification shall be followed for those cables:

1. Strand Count: As indicated in design drawings
2. Fiber type: As indicated in design drawings
3. Fiber coating: 900µm coating color coded. 250µm coating is acceptable for loose buffer cables but they shall be protected with break-out kits with color coded 900µm buffers at both ends of the cable.
4. Fiber protection: aramid yarn around all strands for cables under 24 strands, and aramid yarn and jacket around each subunit (6 or 12 strands) for cables above 24 strands.
5. Jacket type: Flame-retardant PVC jacket or materials with superior performance.
6. Color jacket: jacket shall be orange for OM1 or OM2 fiber, aqua for OM3 or OM4 fiber and yellow for OS1 or OS2 fiber.
7. Fiber termination: fibers shall be field terminated
8. Buffer type: tight buffer
9. Center strength member material: dielectric material

B. Jacket: Cable jackets for fiber optic cables shall comply with Article 770 NEC for correct use in the environment in which they will be used. If at the moment of the bid the SCS installer does not know the environment, in which cables will be used, the SCS installer shall assume plenum rated is required for the project. At a minimum all cables shall have a flame retardant riser rated jacket. Rating shall be printed in the cable jacket.

C. Approved manufacturers: Match selection for optical fiber connectors, 2.13

2.17 OUTSIDE PLANT FIBER OPTICS BACKBONE CABLES

A. Whenever design drawings indicate fiber optics backbone cables to be run between building or outside premises, the following specification shall be followed for those cables:

1. Strand Count: As indicated in design drawings
2. Fiber type: As indicated in design drawings

3. Fiber coating: 250µm coating protected with break-out kits with color coded 900µm buffers at both ends of the cable when cables are terminated in conditioned spaces. When fibers are terminated in outdoor non-conditioned spaces break out kits shall be used with 3 mm tubes with aramid yarn for each fiber. Unprotected 900µm fibers in non-conditioned spaces are not allowed.
4. Rodent protection requirement: required
5. Buffer type: Loose tube.
6. Center strength member material: dielectric material

B. Jacket: All outside plant fiber optics backbone cables shall have UV resistant cable sheathing and a water blocking material to prevent water intrusion. All outside plant fiber optics backbone cables shall be tested and in compliance with following standards:

1. ANSI/TIA-568-C
2. Telcordia GR-20
3. ANSI/ICEA S-87-640

C. Approved manufacturers. Match selection for optical fiber connectors, 2.13

2.18 INDOOR/OUTDOOR FIBER OPTICS BACKBONE CABLES

A. Whenever design drawings indicate indoor/outdoor fiber optics backbone cables to be run between buildings or outside premises, the following specification shall be followed for those cables:

1. Strand Count: As indicated in design drawings
2. Fiber type: As indicated in design drawings
3. Fiber coating: 900µm coating color coded. 250µm coating is acceptable for loose buffer cables but they shall be protected with break-out kits with color coded 900µm buffers at both ends of the cable. When fibers are terminated in outdoor non-conditioned spaces break out kits shall be used with 3 mm tubes with aramid yarn for each fiber. Unprotected 900µm fibers in non-conditioned spaces are not allowed.
4. Rodent protection requirement: required not required
5. Buffer type: tight buffer required loose buffer acceptable.
6. Center strength member material: dielectric material

B. Jacket: All indoor/outdoor fiber optics backbone cables shall have UV resistant cable sheathing and a water blocking material to prevent water intrusion. All outside plant fiber optics backbone cables shall be tested and in compliance with following standards:

1. ANSI/TIA-568-C
2. Telcordia GR-409
3. ANSI/ICEA S-104-696

C. Jacket: Cable jackets for indoor/outdoor fiber optic cables shall also comply with Article 770 NEC for correct use in the environment in which they will be used. If at the moment of the bid the SCS installer does not know the environment, in which cables will be used, the SCS installer shall assume plenum rated is required for the project. At a minimum all cables shall have a flame retardant riser rated jacket. Rating shall be printed in the cable jacket.

D. Approved manufacturers. Match selection for optical fiber connectors, 2.13

2.19 FIBER OPTIC DISTRIBUTION CENTERS

A. All fiber optic cables shall be terminated in fiber optic distribution centers. Inside premises horizontal fiber optic cables shall be terminated in one side (telecommunication room side) in a fiber optics distribution center (FODC). Backbone fiber optic distribution centers shall be terminated at both ends in a FODC. FODC are composed of an enclosure and snap on adapters. These are the specifications of the enclosures for the FODC:

1. Mounting: Use rack mounted FODC enclosures in all rooms where racks are available or any type of rack rails. Use wall mounted FODC enclosures only when racks are not available like in outdoor enclosures, or other spaces different than telecom rooms.
2. Size: SCS Installer shall size the FODC based on the amount of fiber strands to be terminated in the FODC.
3. Front locking doors are required.
4. Locking door shall be transparent doors and shall have labeling cards.
5. Whenever fiber splices are indicated in the design drawings next to an FODC, enclosures shall be selected by the SCS installer as to have spaces to hold splice trays. FODCs under these conditions shall be able to hold the amount of splice trays required for the fiber count indicated in the drawings.

B. These are the specifications of the snap on adapters for the FODC:

1. Style: plate style cassette style for array connector
2. Connector type: LC to match fiber types of fiber optic cables
3. Maximum fiber strands allowed per adapter: 12
4. Security level: non-keyed connector keyed connector
5. Pairing style: duplex

C. Approved manufacturers. Match selection for optical fiber connectors, 2.13

2.20 FIBER OPTICS PATCH CORDS

A. Fiber optic patch cords shall be required for connections from active equipment to FODCs and/or to telecommunication outlets. Fiber optic patch cords shall be required at both ends of fiber optics backbone cables or horizontal fiber optic cables. Direct connection of backbone cables or horizontal fiber optic cables to active equipment shall not be allowed.

B. Fiber optic patch cords shall be all factory tested. Field made fiber optic patch cords are not acceptable. The specifications of the fiber optic patch cords shall be:

1. Strand Count: 2 strands
2. Fiber type: Match fiber type of backbone cable or horizontal cable.
3. Fiber connector in FODC or outlet side: match connector for each adapter
4. Fiber connector in active equipment side: the SCS installer shall coordinate with supplier of equipment the type of connector required in this side.
5. Fiber protection: aramid yarn
6. Jacket type: 2.9mm flame-retardant PVC jacket zip-cord type.
7. Color jacket: jacket shall be orange for OM1 or OM2 fiber, aqua for OM3 or OM4 fiber and yellow for OS1 or OS2 fiber.

C. Approved manufacturers. Match selection for fiber optic connectors

2.21 INSIDE PREMISE MULTIPAIR BACKBONE CABLES

A. Whenever indicated in the drawings multipair backbone cables to be run inside premises and above grade shall have the following specification:

1. Pair count: as indicated in the design drawings
2. Conductor: AWG 24 solid bare copper conductor
3. Input impedance: 100 Ω
4. Conductor insulation: color coded thermo plastic
5. Performance requirement: UL verified to ANSI/TIA-568-C Category 3 5e backbone cable.

B. Jacket: Cable jacket for inside premise multipair backbone cables shall comply with Article 800 NEC for correct use in the environment in which they will be used. If at the moment of the bid the SCS installer does not know the environment, in which cables will be used, the SCS installer shall assume plenum rated is required for the project. At a minimum all cables shall have a flame retardant PVC jacket riser rated.

C. Jacket marking: All inside premise multipair backbone cables shall have at least two types of markings imprinted in the jacket, transmission performance marking and NEC rating for environment to be used.

D. Approved manufacturer: Belden, Superior Essex, General Cable, Berk-Tek or CommScope.

2.22 OUTSIDE PLANT MULTIPAIR BACKBONE CABLES

A. Whenever indicated in the drawings outside plant multipair backbone cables to be run between buildings or inside premises but below grade shall have the following specification:

1. Pair count: as indicated in the design drawings
2. Conductor: AWG 24 solid bare copper conductor
3. Input impedance: 100 Ω
4. Conductor insulation: Solid polyolefin; color coded in accordance with industry standards.
5. Performance requirement: UL verified to ANSI/TIA-568-C Category 3 backbone cable.
6. Shield: Corrugated, copolymer coated, 8 mil aluminum tape applied longitudinally with an overlap; flooded shield interfaces.
7. Jacket: Black, polyethylene

B. Jacket: All outside plant multipair backbone cables shall have UV resistant cable sheathing and a water blocking material to prevent water intrusion. All outside plant multipair backbone cables shall be tested and in compliance with following standards:

1. ANSI/ICEA S-84-608-2007
2. RDUP 7 CFR 1755.390 (PE-39)
3. RoHS-compliant

C. Approved manufacturer: Match selection for inside plant multipair backbone cables.

2.23 TERMINATION OF MUTIPAIR BACKBONE CABLES

A. Backbone multipair backbone cables for inside premises or outside plant shall be terminated in termination blocks or patch panels. See design drawings for specific types on each case.

B. Whenever indicated in the design drawings, multipair backbone cables shall be terminated in patch panels. Patch panels for this purpose shall have the following specifications:

1. Connector type: 8-position modular plug (RJ-45)
2. Connector wiring map: One pair per connector pins 4 and 5 (blue pair).
3. Cable termination type: IDC type connector
4. Performance requirement: CAT3
5. Maximum connectors per path panel allowed: 96
6. Permanent marking: All connectors shall be labeled in sequential numbers
7. Field labels: patch panels shall have a space for field labels covered with transparent protectors.
8. Shielding: Unshielded.

C. Whenever indicated in the design drawings, multipair backbone cables shall be terminated in rack mounted termination blocks. Termination blocks for this purpose shall have the following specifications:

1. Connector type: 110 style connector
2. Cable termination type: IDC type connector
3. Performance requirement: CAT3
4. Rack frame: standard 19” rack.
5. Pair counts: use 100 pair blocks for backbone cables under 100 pairs. Use 200 pair blocks in quantities as required for backbone cables with over 200 pairs.
6. Wire managers: All 200 pair termination blocks shall have a 2 RU wire manager built-in.
7. Clip types: Use 110C4 clips or 110C5 clips.
8. Field labels: termination blocks shall have a space for field labels covered with transparent protectors.
9. Mounting: termination block shall be mounted without legs in the rack plate.

D. Whenever indicated in the design drawings, multipair backbone cables shall be terminated in wall mounted termination blocks. Termination blocks for this purpose shall have the following specifications:

1. Connector type: 110 style connector or 66 Style
2. Cable termination type: IDC type connector
3. Performance requirement: CAT3
4. Pair counts: Use only 300 pair blocks in quantities as required for backbone cables.
5. Wire managers: All termination blocks shall have a wire manager installed at both sides of the blocks and between blocks.
6. Clip types: Use 110C4 clips or 110C5 clips for 110 style block.
7. Field labels: termination blocks shall have a space for field labels covered with transparent protectors.
8. Mounting: termination block shall be mounted with legs on the wall.

E. Approved manufacturers. Match selection for modular SCS jacks

2.24 SITE COPPER PROTECTORS

A. General: When required by NEC or when indicated in the drawings copper circuits shall be provided with protection between each building with an entrance cable protector chassis. All building-to-building circuits shall be routed through this protector. Protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TR ground point.

B. General: Primary protection units shall be composed of a cabinet that supports 5-pin protection modules and termination blocks. The cabinet for protection unit shall have the following specifications:

1. Capacity: 100 pairs
2. Socket type: 5-pin modules
3. Input mode: 110 style IDC connector.
4. Output mode: 110 IDC
5. Grounding lug capacity: AWG 6 to AWG 14
6. Other: stand-off bracket required.

C. The protector unit for digital lines shall have the following specifications:

1. Mounting type: 5-pin module.
2. Protection type: Solid state MOV
3. Pairs per unit: one
4. Protection type: heat coil and sneak current protection
5. DC Breakdown Voltage @ 2kV/sec: 60-90 V
6. Surge Breakdown Voltage @100 V /μsec: 220-300 V
7. Insulation Resistance (PE-80): > 100 M Ω
8. DC Holdover Current: 260 mA/52 V
9. On-State Voltage @ 75 A: < 10 V
10. Response Time: < 100 nsec
11. Rated Impulse Discharge: 100 A
12. Capacitance(VDC=50 V, f=1 kHz, V AC=1 Vrms): < 100pF
13. Line Series Resistance: < 4 Ω
14. Sneak Current Operation (heat coils): 540 mA <210 sec, 1 A <15 sec
15. Listing: UL 497

D. The protector unit for analog lines shall have the following specifications:

1. Mounting type: 5-pin module.
2. Protection type: Solid state MOV
3. Pairs per unit: one
4. Protection type: heat coil and sneak current protection balanced
5. DC Breakdown 240 V

E. Approved Manufacturers for primary protectors: Commscope, Tii, Circa and Emerson

F. All primary protection block shall be used with a secondary protection block. The secondary protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TR ground point. Secondary protection shall have the following specifications:

1. Style: Mounted on a 66-type block.
2. Protection type: solid state and fuse protection
3. Pairs per unit: one
4. Breakdown voltage: selected by SCS installer according to signals protected.
5. Maximum number of protectors per block: 25
6. Listing: UL 497A

G. Approved Manufacturers for secondary protectors: Commscope, Emerson, Siemon

2.25 PATCH CORDS FOR MULTIPAIR BACKBONE CABLES

A. Patch cords shall be used to connect horizontal wiring to termination blocks for multipair backbone cables. Depending on the type of termination for backbone cables, the patch cord shall be selected.

B. When multipair backbone cables are terminated in patch panels, patch cords for these patch panels shall have the same specification as the 4-pair patch cord cables described above.

C. When multipair backbone cables are terminated in wall mounted or rack mounted termination blocks, patch cords shall have a patch plug connector in one end and an 8-pin modular plug (RJ-45) in the other end. The SCS installer shall coordinate with the phone system installer and determine if one pair or two pairs are required for each phone. Patch cords shall have one or two pairs according to the equipment selection. Patch plugs shall only be one or 2 pairs accordingly. Patch plug selection shall match the manufacturer and family of products of the termination blocks.

2.26 QUAD POST RACKS

A. Whenever indicated in the design drawings quad post racks shall be provided as shown. Quad post racks shall be made of aluminum or welded steel frames and shall have a powder coat finish. Quad post racks shall have the following specifications:

1. Depth adjustment: rack rails shall be adjustable from 12.5" to 30" in depth, independent of the structural members allowing racks rails adjustment after racks are anchored.
2. Height: Equipment cabinet shall provide a usable height between 44 and 45 RU.
3. Rack rails type: standards EIA 19" square holes located in the front and back of rack. Rack rails shall have RU marked and labeled.
4. Rack screw type: cage nuts clipped to rack rails. Nuts and screws shall be provided for all slots in rack rails and shall be made of steel threaded as #10-32.
5. Weight capacity: UL listed for 1200 lb or more.

B. Quad post racks shall be provided with the following accessories:

1. Base dust covers that prevent accumulation of dust and debris in rack base.
2. Cable runway mounting brackets to support cable runway installed above racks
3. Isolation pads.
4. Grounding kit.
5. Ground bar: all cabinets shall be provided with a copper vertical ground bar covering the complete length of the rack rails. The ground bar shall be 1/8" thick and 1" wide with threated holes 1032 mounted to the cabinet using nylon insulation washers
6. End panels to support vertical wire managers at the end of each rack row.

C. Front and rear vertical wire managers shall be provided in between all racks and at both ends of rack rows covering from top to bottom of each rack. The specifications of those wire managers shall be:

1. Style: Metal cage with dual hinged door cover finger-duct with removable covers
2. Sides: single sided wire manager (front only).
3. Capacity: Usable cross sectional area shall be minimum of: 130 sq-in
4. Accessories: whenever cable manager supports the use of spools inside the unit, spools shall be provided at all locations in the unit.

D. Approved manufacturer: Match selection for Equipment Cabinets

2.27 TWO POST RACKS

A. Whenever indicated in the design drawings two post racks shall be provided as shown. Two post racks shall be made of aluminum or welded steel frames and shall have a powder coat finish. Two post racks shall have the following specifications:

1. Height: Equipment cabinet shall provide a usable height between 44 and 45 RU.
2. Channel depth: 3"± 1"
3. Rack rails type: standards EIA 19" located in the front and back of rack. Rack rails shall have RU marked and labeled.
4. Rack screw type: #12-24 threaded rack rails. Screws shall be provided for all openings in rack rails and shall be made of steel.
5. Weight capacity: UL listed for 1000 lb or more.

B. Two post racks shall be provided with the following accessories:

1. Cable runway mounting brackets to support cable runway installed above racks
2. Isolation pads
3. Grounding kit.
4. Ground bar: all cabinets shall be provided with a copper vertical ground bar covering the complete length of the rack rails. The ground bar shall be 1/8" thick and 1" wide with threated holes 1032 mounted to the cabinet using nylon insulation washers
5. End panels to support vertical wire managers at both ends of each rack row.

C. Front and rear vertical wire managers shall be provided in between all racks and at both ends of rack rows covering from top to bottom of each rack. The specifications of those wire managers shall be:

1. Style: Metal cage with dual hinged door cover finger-duct with removable covers

2. Sides: single sided wire manager or dual side wire manager.
3. Capacity: Usable cross sectional area shall be minimum of: 130 sq-in.
4. Accessories: whenever cable manager supports the use of spools inside the unit, spools shall be provided at all locations in the unit.

D. Approved manufacturer: Panduit, Ortronics, Belden, Middle Atlantic Products, Great Lakes, Chatsworth Products Inc. or approved equal.

2.28 POWER DISTRIBUTION UNITS (PDUs)

A. All equipment cabinets or racks in the project shall be provided with at least one PDU. PDUs selection shall be as indicated in design drawings.

B. The following specifications are required for all types of PDUs:

1. PDU MONITORING: Unit level monitoring
2. PDU SWITCHING: Not required
3. MONITORING PARAMETERS: All units shall have monitoring through an IP Ethernet line, unless specifically indicated in the description of each PDU. The monitoring shall include the following parameters:
    a. Current and voltage for each phase available in the unit
    b. Peak Voltage, peak current and power factor for each phase available in the unit
4. MONITORING SPECIFICATIONS:
    a. Unit shall have an LCD display to show all monitoring settings with scrolling capabilities.
    b. All PDUs and power transfer shall be the same brand and they should be monitored with the same DCIM software.
    c. The unit shall be capable of using threshold remote alarms through e-mail, SNMP traps or XML.
    d. DCIM software shall be optional. No need for external software, all features shall be available through web browsing if external software monitoring is available
5. All devices shall have a continuous operating temperature range of 50 to 113 DEGF.

C. PDU Type 1:

1. PDU capacity: 125V 20A
2. Quantity of power outlets: No less than 14
3. Power outlet configuration: NEMA 5-15R
4. Strip power cord plug: NEMA L5-20P
5. Breaker: built in thermal breaker with guard protection. Capacity to match PDU capacity
6. Monitoring: digital display included with readings of amperage and voltage
7. Surge suppression: included and built-in.
8. Listing: UL listed
9. Mounting: vertically mounted, not occupying any rack space, with mounting accessories. The installation of the PDU shall not prevent the removal or installation of equipment in the rack.

D. PDU Type 2:

1. PDU capacity: 125V 30A
2. Quantity of power outlets: No less than 10
3. Power outlet configuration: NEMA 5-20R
4. Strip power cord plug: NEMA L5-30P
5. Breaker: built in thermal breaker with guard protection. Capacity to match PDU capacity.
6. Monitoring: digital display included with readings of amperage and voltage
7. Surge suppression: included and built-in.
8. Listing: UL listed
9. Mounting: vertically occupying 1 RU of space. The installation of the PDU shall not prevent the removal or installation of equipment in the rack.

E. Approved manufacturer: Geist Manufacturing, Raritan, Server Technologies, APC, Panduit or approved equal.

2.29 RACK MOUNTED UNINTERUPTED POWER SUPPLY (UPS)

A. All equipment cabinets or racks in the project shall be provided with one uninterrupted power supply (UPS). UPS selection per rack shall be as indicated in design drawings. The following descriptions apply to each type of UPS:

B. UPS units labeled in drawings as “208V UPS” shall have the following specifications:

1. Output power capacity: 4000 W/5000 VA
2. Output voltage: 120V and 208V, using a transformer
3. Efficiency at full load: 95%
4. Output voltage distortion: Less than 5% at full load
5. Output Frequency: (sync to mains) 57 - 63 Hz for 60 Hz nominal
6. Topology: Line Interactive
7. Waveform Type: Sine wave
8. Output Connections: (12) NEMA 5-20R, (2) NEMA L6-20R and (1) L6-30
9. Nominal Input Voltage 208V
10. Input Frequency 50/60 Hz +/- 5 Hz (auto sensing)
11. Input Connections NEMA L6-30
12. Battery Type Maintenance-free sealed Lead-Acid battery with suspended electrolyte, leak-proof.
13. Run time: 9 minutes at full load
14. Communications: RJ-45 10 Base-T Ethernet for web/ SNMP/ Telnet management included.
15. Surge energy rating 1020 Joules
16. Filtering Full time multi-pole noise filtering: 0.3% IEEE surge let-through: zero clamping response time: meets UL 1449
17. Rack Height: no bigger than 7U, including transformer
18. Regulatory Approvals CSA, FCC Part 15 Class A, UL 1778.

C. UPS units labeled in drawings as “120V Medium UPS” shall have the following specifications:

1. Output power capacity: 2700 W/2880 VA
2. Output voltage: 120V
3. Output voltage distortion: Less than 5% at full load
4. Output Frequency: (sync to mains) 57 - 63 Hz for 60 Hz nominal
5. Topology: Line Interactive
6. Waveform Type: Sine wave
7. Output Connections: (6) NEMA 5-15R, (2) NEMA 5-20R
8. Nominal Input Voltage 120V
9. Input Frequency 50/60 Hz +/- 3 Hz (auto sensing)
10. Input Connections NEMA L5-30
11. Battery Type Maintenance-free sealed Lead-Acid battery with suspended electrolyte, leak-proof.
12. Run time: 3.5 minutes at full load
13. Communications: RJ-45 10 Base-T Ethernet for web/ SNMP/ Telnet management included.
14. Surge energy rating 459 Joules
15. Rack Height: no bigger than 2U
16. Regulatory Approvals CSA, FCC Part 15 Class A, UL 1778.

D. For Equipment cabinet and small AV equipment credenza racks and UPS units labeled as “120V Small UPS” shall have the following specifications:

1. Output power capacity: 500 W/750 VA
2. Output voltage: 120V
3. Output voltage distortion: Less than 5% at full load
4. Output Frequency: (sync to mains) 57 - 63 Hz for 60 Hz nominal
5. Topology: Line Interactive
6. Waveform Type: Sine wave
7. Output Connections: (6) NEMA 5-15R
8. Nominal Input Voltage 120V
9. Input Frequency 50/60 Hz +/- 3 Hz (auto sensing)
10. Input Connections NEMA 5-15P0
11. Battery Type Maintenance-free sealed Lead-Acid battery with suspended electrolyte, leak-proof.
12. Run time: 5.5 minutes at full load
13. Communications: RJ-45 10 Base-T Ethernet for web/ SNMP/ Telnet management included
14. Surge energy rating 459 Joules
15. Rack Height: no bigger than 2U

16. Depth: Unit shall be no deeper than 18”
17. Regulatory Approvals CSA, FCC Part 15 Class A, UL 1778.

E. Approved manufacturers: APC, Liebert, Tripplite or approved equal. All UPS types shall be provided from the same manufacturer

2.30 MEDIA CONVERTERS

A. General. When telecommunications outlets exceed distance limitations to pass testing requirements, the SCS installer shall provide media converters and fiber optics connectivity to overcome this problem. The media converters shall have the following specifications:

1. Power: All power for media converters in the field end (i.e. camera or WAP side) shall be powered from the Telecom room side using a hybrid cable. Local power adapters for media converters are not acceptable in the field end.
2. Cabling: A composite cable shall be used for these devices. This composite cable shall have a minimum of 2 strands of fiber optics and 1 pair of copper cable AWG-12 for the remote end power. The quantity of fiber strands for this cable shall be as required by the type of media converter used. The fiber types shall be as required by the media converter. The cable jack for this composite cable shall be selected as required for the application. Any cables being pulled underground shall have a water blocking jacket.
3. Port count: Media converters with 1 port or 4 ports are acceptable.
4. PoE support: Media converters shall support PoE without the need of an external power adapter and the field end.
5. Fiber connection speed. Media converters shall support 1GB connections in the fiber port.
6. PoE capacity: Media converters shall support PoE+ (30W) for all outdoor cameras and all WAPs. Media converter shall support 15,4 W for all other PoE devices.
7. Power supplies: Media converters shall be provided with the corresponding power supplies at the telecom room.

B. Basis of design; Transition Networks solutions or similar.

2.31 CABLE TIES

A. Cable ties shall be used at different locations of the project but with the same goal of producing a neat and organized installation. Cable ties shall be used to support cables to j-hooks (when j-hooks are allowed in the project) to organize cables in ladder trays, D-rings and cable trays, to support cables to wire managers including managers behind patch panels, to bundle cables, organize patch cords, etc.

B. To support and organize all horizontal cabling and inside premise backbone cables, only the following types of cable ties shall be used:

1. Hook and loop style, re-usable with Velcro no smaller than 0.5” width.
2. Pre-perforated rolls of re-usable ties with Velcro no smaller than 0.5” width
3. Straps of other soft materials with cinch rings that allow for re-use of the cable ties in widths no smaller than 0.85”.

C. Nylon based cable ties (re-usable or not) can only be used to support and organize the following types of cables:

1. Outside plant fiber and copper backbone cables.
2. Inside premise fiber optic backbone cables with interlock armors.
3. Grounding conductors

D. Nylon based cable ties shall never be used to support or organize any type of horizontal cables or inside premise fiber optic backbone cable without armor.

E. All cable ties to be used in outdoor environments shall be made of weather resistant Acetal. Outdoor cable ties used for aerial cable lacing shall be in compliance with Telcordia TR-TSY-000789 standard.

F. All cable ties shall be selected in lengths as to properly secure the bundle of cable being supported.

G. All cable ties to be used in air handling spaces, such as above ceiling and under raised floor areas, shall be UL listed for the use in those environments.

H. Approved manufactures: Ortronics, Panduit or approved equal

2.32 IDENTIFICATION AND LABELING TAGS

A. SCS installer shall follow labeling materials indicated in specification section 270010.

PART 3: EXECUTION

3.01 INSTALLATION PRACTICES.

A. GENERAL. All installation requirements indicated in specification section 270010 shall be followed.

B. WORKMANSHIP. All work shall be completed by the SCS installer in a neat and workmanlike manner. The use of all BICSI standards and recommendations for installation shall be followed as the benchmark for workmanship.

C. CABLE LENGTHS. It is the SCS installer's responsibility to plan the cable routing in the cable tray and other raceways as to minimize all cable runs to be able to stay under the 90 meter (295 ft) length limitation for Horizontal Cabling. All cable runs exceeding the wiring distance, due to raceways run in not the most efficient way to minimize distance, shall be re-run with horizontal fiber optic cables and with media converters, at no extra cost to the owner.

D. WIRE MAPPING. All terminations of 4-pair horizontal cabling in this project and terminations of all 4-pair patch cords shall be per T568A T568B standard.

E. FIBER OPTICS TERMINATION POLARITY. All fiber optic cables (horizontal or backbone) terminated in duplex style adapter panels shall be connected in a cross-over polarity configuration. As an example, if fibers 1 and 2 are terminated in one end in positions A and B respectively in one side of the cable, the same strands shall be terminated in B and A positions in the other side of the cable.

F. POLARITY FOR FIBER OPTICS ARRAY CONNECTORS. Array connectors and cassettes for this project shall use Method C polarity system as outline in TIA-568.B.1

G. LOCATION OF HORIZONTAL TERMINATIONS. In a multi-story facility with telecommunications room in every floor, all horizontal drops, whether terminated in the wall or in floor boxes shall be terminated in the same floor telecommunications room as the location of the final outlet.

H. CABLE BUNDLES. In suspended ceiling and raised floor areas if duct, cable trays or conduits are shown on the contract drawings, the SCS installer shall bundle, in bundles of 40 or less, horizontal wiring with cable ties snug, but not deforming the cable geometry. The cable bundling shall be supported via "CLIC" fasteners in TR's and non-plenum areas and J-hooks in ceiling spaces. The SCS installer shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.

I. CLIC FASTENERS: Horizontal cables shall be suspended by "CLIC" fasteners with cable inserts in TR's on the plywood area where ladder tray or rack management is not available per the design documents. Listings: "CLIC" fasteners shall be in accordance with NEC and BICSI standards. Above the plywood area J-hooks or D-rings should be used.

J. FIRE STOP PROTECTION: Sealing of openings between floors, through rated fire and smoke walls, existing or created by the SCS installer for cable pass through shall be the responsibility of the SCS installer. Sealing material and application of this material shall be accomplished in such a manner, which is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the SCS Installer's work. Any openings created by or for the SCS installer and left unused shall also be sealed as part of this work. Penetration rating shall equal structure rating.

K. NEW MATERIALS: All components, wiring and materials to be used for the installation of the SCS shall be new and free of defects. Used components, wiring and materials shall only be used when specifically indicated in the design drawings.

L. DAMAGE: The SCS Installer shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces including painting and ceiling tile replacement shall be included as part of this contract.

M. AVODING EMI: To avoid EMI, all pathways shall provide clearances of at least 4 feet (1.2 meters) from motors or transformers; 1 foot (0.3 meter) from conduit and cables used for electrical-power distribution; and 5 inches (12 centimeters) from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical-power cables and conduits. The SCS installer shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.

N. WORK EXTERNAL TO THE BUILDING: Any work external to the confines of this building as shown on the drawings shall be governed by the provisions of this specification.

O. DEMOLITION. Any task part of the installation of the SCS requiring relocation, rerouting and/or demolition shall be done according to the following requirements:

1. Coordination: Prior to any deactivation and relocation or demolition work, arrange a conference with the Architect and the Owner's representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.
2. Provisions: All deactivation, relocation, and temporary tie-ins shall be provided by the SCS installer. All demolition, removal and the legal disposal of demolished materials of system designated to be demolished shall be provided by the SCS installer.
3. All Existing Voice/Data cables and connecting hardware not to be used after the new installation is complete and within the areas where work is required as part of this project shall be removed by the SCS installer. All existing cables to be left for future use if indicated by the owner shall be tagged for that purpose.
4. Owners Salvage: The Owner reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.
5. Phasing: The SCS installer shall perform all work in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.

P. ICONS. Faceplates, jacks or patch panels with inserts for icons shall be filled with icons when unit capable of accepting icons. Icons in the work area side (outlet) shall match the color of the faceplate. Icons for path panels shall match the color of the horizontal cabling.

Q. BLANK INSERTS AND PANELS. All telecommunications outlets with faceplates or mounting frames with unused terminations shall be plugged with blank inserts or panels. Blank inserts shall match the color of the faceplate or mounting frame. No more than one blank module shall be required for each faceplate. All unused ports in the FODC enclosures for adapter panels shall be filled with blank adapter panels.

R. PATCH PANEL AND FODC SEPARATION: Horizontal cables shall be terminated in separate patch panels according to the use of the cable. Each series of patch panels or FODC for a specific use shall have at least 20% spare capacity of ports. Patch panels of the same use shall be mounted consecutive in the equipment cabinets or racks. The following separation for patch panels and FODCs shall be provided:

1. Cables for Wireless Access Points (WAPS) shall be separated from cables for any other purpose.
2. Cables for surveillance cameras shall be separated from cables for any other purpose.
3. Cables for voice drops shall be separated from cables for data drops.
4. Cables for any other specialty systems like security systems, nurse call systems or others shall all be terminated in separate patch panels from any other cables.
5. Horizontal fiber optic cables shall be terminated in separate FODC from fiber optics backbone cables.
6. Single mode fiber optic backbone cables shall be terminated in separate FODC from multimode fiber optic backbone cables.

S. SUPPORTS FOR REAR OF PATCH PANELS. All patch panels for horizontal cables shall be provided with a rear support bar to hold the cable and to provide strain relief. At a minimum one rear support bars shall be provided for each two rows of 24 connectors.

T. HORIZONTAL WIRE MANAGERS. Horizontal wire managers shall be provided following this criteria:

1. At least one above and below each straight (flat) patch panel.
2. At least one top and bottom of each series of angled or curved patch panels.
3. At least one above and below any network switches.
4. At least one below any rack mounted termination block.

U. CROSS OVER WIRE MANAGERS. Cross over wire managers shall always be used with angled or curved patch panels. One cross over wire manager shall always be installed in the middle of each rack at the same height on every rack.

V. PATCH CORD QUANTITY, COLOR AND LENGTHS. Copper and fiber optics patch cords shall be provided per following chart. All percentage calculations shall be rounded off to the nearest integer number.

TYPE	QTY	COLOR JACKET	LEGTH
4-pair at work area outlet	One for 90% of all 4-pair horizontal cables in the project	Match horizontal cable color jacket	30% 8', 50% 10' and 20% 14'
4-pair at WAP location	One for 100% of all 4-pair horizontal cables for WAPS in the project + 10% spare	Match horizontal cable color jacket	The SCS installer shall field verify all lengths to match location of WAPS selected by owner or wireless survey. For pricing purposes use 12'
4-pair at Surveillance camera	One for 100% of all 4-pair horizontal cables for cameras in the project +10%	Match horizontal cable color jacket	The SCS installer shall field verify all lengths to match location of cameras. For pricing purposes use 12'
4-pair at patch panel side (excluding surveillance cameras and WAPS)	One for 90% of all 4-pair horizontal cables in the project	Match horizontal cable color jacket .	For pricing purposes use: 40% 6', 40% 8', 20% 12'. SCS installer shall field verify these percentages to provide more accuracy.
4-pair at patch panel side (surveillance cameras and WAPS)	One for 100% of all 4-pair horizontal cables in the project +10%	Match horizontal cable color jacket .	For pricing purposes use: 40% 6', 40% 8', 20% 12'. SCS installer shall field verify these percentages to provide more accuracy.
2-strand fiber optics at work area outlet	One for 100% of all 2-strand horizontal fiber cables in the project + 10% spare	Per fiber type	50% 8' and 50% 10'
2-strand fiber optics at FODC.	One for 100% of all horizontal 2-strand fiber cables and one for 83% of all fiber strands of backbone cables in the project. For example a 24 strand cable shall require 20-2-strand patch cords or 10 for each side of the cable	Per fiber type	For pricing purposes use: 20% 6', 60% 10'. 20% 14' SCS installer shall field verify these percentages to provide more accuracy.
One or two pair for copper backbone cross connects	One for 90% of all backbone copper pairs installed in the project.	Gray	For pricing purposes use: 80% 8', 20% 10'. SCS installer shall field verify these percentages to provide more accuracy.

W. CABLE SLACK. Cable slack shall be provided for all cables in the project following this guideline:

1. At each work area outlets, all horizontal cables shall have 12" of slack.
2. At the telecom room side all horizontal cables shall have at least 6' neatly organized on the wall using a figure 8 configuration or a non-loop shaped arrangement with Velcro straps.
3. Backbone cables at termination points shall have at least 15' of slack neatly organized on the wall using a standard loop and Velcro straps.

4. Outside plant backbone cables run through in-ground pull boxes greater than 24”X24” shall include one service loop inside the box.

X. BEND RADIUS. Installation of Fiber Optic Cables shall be in accordance with ANSI/TIA-568C guidelines and cable manufacturer specifications. Bend radius parameters shall be followed for load and no load conditions. Cable installation and terminations that do not comply shall be replaced by the SCS installer. If no recommendation is specified by cable manufacturer, at least the following criteria shall be meet:

1. The bend radius for intrabuilding 2 and 4-fiber horizontal optical fiber cable shall not be less than 25 mm (1 in) under no-load conditions. When under a maximum tensile load of 222 N (50lbf), the bend radius shall not be less than 50 mm (2 in).
2. The bend radius for intrabuilding optical fiber backbone with fiber counts above 4 shall not be less than 10 times the cable outside diameter under no-load conditions and no less than 15 times the cable outside diameter when the cable is under tensile load.
3. The bend radius for interbuilding optical fiber backbone shall not be less than 10 times the cable outside diameter under no-load conditions and no less than 20 times the cable outside diameter when the cable is under tensile load up to the rating of the cable, usually 2670 N (600lbf).

Y. INNERDUCT. Innerduct shall be provided from end to end of a raceway system under the following conditions:

1. Inside underground conduits as indicated in design drawings.
2. For horizontal fiber optic cable or inside premise fiber optics backbone cables without interlocking armor when routed through cable trays, ladder trays or vertical conduit sleeves. This requirement is usually not indicated in the drawings but indicated only in this specification.
3. For backbone fiber optic cable in vertical risers

Z. SCS PROTECTION DURING CONSTRUCTION. The SCS installer shall protect all SCS materials from damage during construction.Racks shall be covered with fabric or plastic after mounting to prevent dust, debris and other foreign materials having contact with SCS devices. The SCS installer shall protect at all times all fiber optic and copper cables from damage during installation. All cables shall maintain the physical integrity as manufactured for testing and delivery to the owner. All damaged cables shall be replaced at no additional cost to the owner.

AA. CABLE BONDING. Shielded cables or cables with metal strength or protection members (like interlocking armor) shall be bonded to the telecommunications grounding system as indicated in specification section 270526.

BB. RACK INSTALATION. All racks shall be installed leveled and plumbed. Four post racks and two post racks shall be anchored to the floor and shall be installed with isolation pads. Equipment cabinets shall be leveled using the leveling feet unless design drawings specifically indicate to leave them on the casters.

CC. RACK BONDING. All equipment cabinets and racks shall be bonded to the telecommunication grounding system as indicated in specification section 270526.

3.02 IDENTIFICATION AND TAGGING

A. General: Identification and tagging of SCS components shall be executed by the SCS installer. At a minimum identification and tagging shall be provided for the following components of the system:

1. All horizontal and backbone cables at both ends of the cable in the cable jacket. Labels on each side shall be different indicating the location of the other side of the cable
2. All faceplates indicating all jacks terminated in the faceplate.
3. All patch panels.
4. All racks
5. All termination blocks
6. All telecommunication rooms and outdoor enclosures.
7. All interbuilding backbone cables inside in ground pull boxes outside of the building shall have a visible label in each box they pass through.

B. The SCS installer shall follow the owner provided identification system. If owner does not have any preference or standard the SCS installer shall provide a system for approval of the A&E and the owner as indicated in the submittal paragraph of this specification. The identification system shall follow the TIA/EIA 606-B standard.

3.03 TESTING OF COPPER CABLING

A. General: Horizontal and backbone cabling shall be verified in accordance with ANSI/TIA/EIA-568-C, Cabling Transmission Performance and Test Requirements.

B. For all 4-pair copper cabling terminated for the use of building systems or system provided under the contract, such as surveillance cameras, emergency phones, elevator phones, WAPs, Access control panels and building automation equipment, the required test shall be a Channel style test. This means copper test shall be done with patch cords that will be used for permanent installation of those devices.

C. For all 4-pair copper terminated for the use in work areas such as computers and phones, the test method selected for all 4-pair copper cabling is a permanent link style test. Permanent link test is defined as a test that does not include the patch cords to be used in the project.

D. General: In the event the A&E elects to be present during the tests, provide notification to the engineer two weeks prior to testing.

E. General: The installer's RCDD shall sign off on all copper and fiber optic cable test results, indicating that he/she was in responsible charge of all cable testing procedures and that all cables were tested in compliance with the contract documents and met or exceeded the requirements stated herein.

F. Testing Equipment: Tester shall be as manufactured by Agilent, Fluke, IDEAL or Wavetek. Tester shall be 100% Level III Level IIIe compliant with ANSI/EIA/TIA 568C specifications for testing of the CAT6 ~~CAT6A~~ cabling. No tester will be approved without meeting these requirements.

G. Each jack in each outlet shall be tested at a minimum to the manufacturer's performance of the cable to verify the integrity of all conductors and the correctness of the termination sequence. Testing shall be performed between work-areas and the equipment rack patch panel. Prior to testing UTP runs, the tester shall be calibrated per manufacturer guidelines. The correct cable NVP shall be entered into tester to assure proper length and attenuation readings.

H. Documentation of cable testing shall be required. The SCS installer shall provide the results of all cable tests in electronic format (final results in PDF format and raw data). Each test page shall be separated by standard page break (one test per page). The test results shall include: sweep tests, continuity, polarity checks, wire map, Attenuation, NEXT, PSNEXT, FEXT, PSFEXT, ELFEXT, PSELFEXT, ACR, Return Loss, Delay Skew, and the installed length. Cables not complying with the EIA/TIA 568C tests results shall be identified to the A&E for corrective action which may include replacement at no additional expense to the Owner. All identification names of the cables used in the test shall match the labeling system approved for the project and the corresponding shop drawings.

I. Any Fail, Fail*, Pass* or WARNING test result yields a Fail for the channel or permanent link under test. In order to achieve an overall Pass condition, the result for each individual test parameter must be passed. All test results shall come from a tester with the permanently enabled marginal reporting feature.

J. Test results shall show and comply with the margin claimed by the manufacturers over CAT6 ~~CAT6A~~ permanent link specifications on all transmission parameters across the entire frequency range as shown on the manufacturer's cut sheets.

K. General: Copper multipair backbone cabling shall be tested for length, continuity, polarity checks and wire map. The SCS Installer shall provide the results of all Copper Riser cable tests in electronic format. The use of pigtails or special harness could be required to properly test these cables.

L. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests.

M. All 4-pair patch cords shall be factory tested only.

3.04 TESTING OF FIBER OPTICS CABLING

A. General: Horizontal and backbone cabling shall be verified in accordance with ANSI/TIA/EIA-568-C and the addendum for fiber optic testing.

B. General: In the event the Engineer elects to be present during the tests, provide notification to the engineer two (2) weeks prior to testing.

C. Cleanness: All fiber optics connector shall be cleaned properly before any testing and after testing. Proof of cleanness shall be required during the acceptance test for the SCS by the A&E. SCS installer shall have available during this test a 200X microscope or a video probe to demonstrate the cleanness of the randomly selected connectors by the A&E.

D. End to End Attenuation Test: The SCS installer shall perform end-to-end attenuation testing for each multimode fiber at 850 nm and 1300 nm from both directions for each terminated fiber span in accordance with EIA/TIA-526-14A (OFSTP 14) and single-mode fibers at 1310 nm and 1550 nm from both directions for each terminated fiber span in accordance with TIA/EIA-526-7 (OFSTP 7). A one jumper reference shall be used for all testing. For spans greater than 90 meters, each tested span must test to a value less than or equal to the value determined by calculating a link loss budget. For horizontal spans less than or equal to 90 meters, each tested span must be < 2.0 dB. When calculating the link loss budget for spans greater than 90 meters use the values listed below. End to end attenuation shall be done with a Level II meter using a meter and light source equipment (also known as main and remote unit)

ATTENUATION DUE TO	FIBER TYPE	MAX. ATTENUATION
Terminating connectors. Field terminated options	All fiber types	0.75 dB per connector
Terminating connectors, pre-term fibers	All fiber types	No more than 0.2 dB additional to total dB loss measured at the factory in report sent by cable manufacturer.
Splices	All fiber types	0.3 dB per splice
Distance	OM1 (850nm/1300)	3.4 dB /1.0 dB per Km.
Distance	OM2, OM3 and OM4 (850nm/1300)	3.0 dB /1.0 dB per Km.
Distance	OS1 and OS2 (1310 nm/1383 nm/1550 nm)	0.65 dB /0.65 dB/ 0.5 dB per Km.

E. OTDR Test. Additional to end to end attenuation test, all fiber optic cables shall be tested with a Level III OTDR equipment for the following conditions:

1. Each known event (connector/splice) insertion loss at both windows for each fiber type (850/1300 nm for multimode and 1310/1550 nm for single mode). All events shall pass maximum allowed insertion loss for the event type as indicated in table above.
2. Reflective events (connections) shall not exceed:
    a. 0.75 dB in optical loss when bi-directionally averaged
    b. -35 dB Reflectance for multimode connections
    c. -40 dB reflectance for UPC singlemode connections
    d. -55 dB reflectance for APC singlemode connections
3. Non-reflective events (splices) shall not exceed 0.3 dB.
4. Estimated distance for multiple strands of the same cable shall not vary more than 1% between strands.
5. Cable signature in the form of traces along the complete distance of the cable. Unexplained cable reflections shown in the OTDR shall require the installer to submit letter explaining such events and pictures of cable conditions in the locations where the unexplained events are located to demonstrate cable has not been kinked or damaged during installation.

F. OTDR Test conditions. All OTDR testing shall be performed with the following conditions:

1. Use a launch cable and a tail cable in accordance with fiber type being tested and requirements indicated by OTDR equipment manufacturer.
2. Launch and tail cables shall be products sold by testing equipment manufacturer and not field made cables.
3. Launch and tail cables shall be selected according to the type of connector being tested such as APC or UPC type connectors.
4. Use launch compensation mode during the test to subtract the effects of the launch and tail cables.
5. Test from one direction only, unless the presence of "gainers" are spotted during the test. In such case the installer shall test in both directions and adjust the test equipment to average measurements from both directions.
6. The SCS installer shall verify the backscatter coefficient use in the test to make sure it matches the coefficient of the cable being tested.

G. OTDR Testing Equipment used on this project shall have the specifications indicated in this following table:

SPECIFICATION	MULTIMODE	SINGLE MODE
Wavelengths	850 nm ±10 nm 1300 nm +35 / -15 nm.	1310 nm ±25 nm. 1550 nm ±30 nm.
Event Dead Zone. Measured at 1.5 dB below non-saturating reflection peak with the shortest pulse width. Reflection peak < -40 dB for mm and < -50 dB for sm.	850 nm: 0.5 [3.7] m typical 1300 nm: 0.7 [3.5] m typical	1310 nm: 0.6 [3.5] m typical 1550 nm: 0.6 [3.5] m typical
Attenuation Dead Zone. Measured at ± 0.5 dB deviation from backscatter with the shortest pulse width. Reflection peak < -40 dB for mm. and < -50 dB for sm.	850 nm: 2.2 [10] m typical 1300 nm: 4.5 [13] m typical	1310 nm: 3.6 [10] m typical 1550 nm: 3.7 [12] m typical
Pulse Widths (nominal)	850 nm: 3, 5, 20, 40, 200 ns. 1300 nm: 3, 5, 20, 40, 200, 1000 ns.	3, 10, 30, 100, 300, 1000, 3000, 10000, 20000 ns
Loss Threshold Setting	0.01 dB to 1.5 dB Adjustable in 0.01 dB increments	0.01 dB to 1.5 dB Adjustable in 0.01 dB increments

H. The Test Report for each fiber strand shall include the following information:

1. Calculated Loss Budget for each optical fiber link (see attenuation table above)
2. Cable/strand ID matching shop drawings labeling system.
3. Name of technicians who performed the test.
4. Date and time the test was performed.
5. Measurement direction (from/to)
6. Jumper reference set up date/time and attenuation value
7. Equipment model and serial number used and calibration date.
8. End to End Attenuation Loss Data for each optical fiber link
9. OTDR Traces, one page per strand. Expand chart to cover most of the page
10. Each event loss data and test limits used, including test limit file date used.

I. For fiber optic cables with factory terminated connectors or pre-terminated pig-tails, The SCS installer shall provide also the test results performed at the factory for fiber optic cables with factory terminated connectors to compare with the field test done by the SCS installer. No significant variation between the factory test results and the field test results shall be encountered.

3.05 SYSTEMS WARRANTY AND SERVICE

A. SCS Installer shall follow all warranty and service requirements indicated in specification section 270010.

B. Warranty: The SCS shall be required to be under the manufacturer's warranty program for a complete channel configuration including cable, jacks, patch cords and patch panels and include cabling specifically approved for the channel configuration with the manufacturer's components. Manufactures shall provide the warranty worst-case performance data for the installed cabling system, and the performance data indicated in the warranty documents/certificate.

C. A twenty five (25) year warranty available for the Structured Cabling System (Fiber optics and copper infrastructure) shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof.

D. Additional features of the warranty shall include:

1. That the SCS installed system complies with the margin claimed by the manufacturer above the ***category 6*** channel specifications on all transmission parameters across the entire frequency range of 1-600 MHz as shown on the manufacturers catalogs and literature.

3.06 SPARE PARTS

A. As part of this contract the SCS installer shall provide the following spare parts.

1. Ten (10) modular SCS jacks.
2. Five (5) faceplates
3. Two (2) faceplates with support post.
4. Ten (10) fiber optic connector of each type used in the project.

B. As part of this contract the SCS installer shall provide the following tools:

1. Two (2) modular SCS jacks termination tools when modular SCS jacks required a manufacturer specific tool.
2. One (1) punch down tool with a 110 blade and one 66 blade.
3. One electric (1) cable finder.

3.07 COMISSIONING

A. SCS Installer shall follow all warranty and service requirements indicated in specification section 270010.

3.08 ENGINEER'S FINAL ACCEPTANCE TEST

A. SCS Installer shall follow all requirements for final acceptance indicated in specification section 270010.

B. The Engineer's final acceptance test will not include testing of structured cabling components, but could include verification of cleanness of fiber optic connectors.

3.09 TRAINING AND INSTRUCTION

A. Training shall only be done after all testing, identification process have been completed and passed as indicated in this specification. Any training done prior to final acceptance will not be accounted for the formal training requested and the SCS installer shall re-do all training after the final acceptance test is passed, at no additional cost to the Owner.

B. SCS Installer shall follow all training requirements indicated in specification section 270010.

C. The training for the SCS shall include the following topics:

1. Detail explanation of the identification system.
2. A walkthrough of all spaces and locations where terminations have been done in the project.

3.10 AS BUILT DOCUMENTS AND PROJECT CLOSE OUT

A. The SCS shall follow all requirements for as-build and close out documents indicated in specification section 270010.

B. The following are additional requirements supplementing the information provided in specification section 270010:

1. Provide the Warranty certificate issued by the manufacturer of the SCS infrastructure.
2. The installer's RCDD shall affix his/her stamp to the as-built drawings, indicating that he/she has reviewed and approved the drawings as being complete, accurate, and representative of the system as actually installed.
3. As built drawings inside each telecom room. The SCS installer shall plot all as-built drawings and locate them inside each of the telecom rooms in the project. Each telecom room shall have the as-built drawings of the areas being served from that room. Each drawing shall be placed inside a clear vinyl document protector the size of the actual design drawing and affixed to a wall/plywood in the telecom room. The document protector shall be re-usable and shall allow the owner to replace the drawings as changes are done to the SCS infrastructure in the future. Without this information, substantial use of the system will not be provided to the installer.
4. The SCS installer shall provide Excel software spreadsheet that defines the telecommunications outlet number, location, number of voice, data and special jacks. This database shall also provide the outlet patch panel connection to the riser/inter-floor cable, equipment, and telephone company demarcation circuit pairs as part of the as-built documentation.
5. Electronic copies of all test results (copper and fiber). Electronic copies shall include raw data files and PDF files with results. PDF files shall be organized the following way:

    a. All copper cables for cables terminating in one telecom room in a single PDF files with the name equal to the label used in the shop drawings for the telecom room where the cables are terminated.

b. All attenuation and OTDR test for all strands of a single cable shall be in one PDF file with the name corresponding to the Cable ID used in the shop drawings.

END OF SECTION 27 10 00

SECTION 28 10 00
ELECTRONIC SECURITY SYSTEMS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The scope of work shall include furnishing all labor, materials, enclosures, wiring, equipment, programming, training, testing, documentation and warranty support, required to provide a completely operational and working Security System. Any materials or equipment necessary for the proper operation of this system, whether or not specified or described herein, shall be deemed part of this system and shall be provided by the Installer without any additional cost to the client.

B. The Security System Installer (SSI) shall coordinate with the door hardware contractor on the placement of all electronic locking hardware for this project. The door hardware contractor shall provide and install all electronic door locking hardware, power transfer hinges, REX switches, REX pushbuttons, REX motion sensors, DPS door contacts, and the low voltage power supplies for delayed egress and electric latch devices. The SSI shall provide the low voltage power supplies for all other electric locks, wire and cable, shall terminate all connections, and shall interface this equipment with the integrated security system.

C. All materials for the structured cabling system (4-pair STP cables, fiber optic cables and 24-AWG multi-pair (25 pairs or higher) components required for the security system shall be in compliance with specification Section 27 10 00 and shall be provided under the same SCS warranty provided under 27 10 00.

D. Network components, wiring, and fiber optic cabling shall conform to all owner established requirements, standards, and practices.

1.02 RELATED DOCUMENTS

A. General Terms and Conditions of the Contract Documents

1. Division 8 – Door Hardware
2. Division 26 – Electrical
3. Division 27 - Systems

B. The Division 26 Electrical contractor shall provide conduit infrastructure to support the security system. The (SSI) shall coordinate with the Electrical contractor to ensure the proper location and placement of this equipment. Conduit shall be provided from the device to a location of accessible space. The SSI shall provide all necessary j-hooks to route their wire and cable from this location to the nearest cable tray or communications room. Where available, the SSI can utilize cable tray infrastructure provided by others to route their cabling throughout this facility. Within the communication rooms all conduit necessary to route cabling from a rough-in location, to and between equipment racks or panels, shall be provided under this scope of work.

1.03 CONTRACTOR QUALIFICATIONS

A. The SSI selected for this project must be a direct manufacturer authorized representative of the product they propose to provide. All technicians assigned to install and configure this system shall be factory trained and certified for the proper installation of this equipment. The SSI must have a minimum of 5 qualified and factory trained technicians to support this system. This company must be of established reputation and experience, regularly engaged in the supply and support of such systems for a period of at least five consecutive years. This company shall have a fully staffed office of sales and technical support representatives within 100 miles of travel time to this project.

B. Other required SSI qualifications are:

1. The SSI shall agree, in writing, as part of their proposal, to provide both warranty and non-warranty service within 4 hours of notification of a problem. The SSI shall be able to perform any and all repairs to the system within 24 hours.
2. The SSI, as a minimum, must carry a current state issued limited energy license.

1.04 SYSTEM DESCRIPTION

A. Provide an extension of the existing ADT security system.

B. The security systems primary purposes shall be to provide alarm monitoring capabilities for this new project. The system shall provide the ability to regulate and control access through specific areas of the facility and shall fully integrate with other security components such as closed circuit television and video recording.

1.05 SUBMITTALS

A. The submittal process for this scope of work will be a two stage process. The first stage is the product/installer approval. Within 30 business days of receiving contract approval and notice to proceed, the following items shall be submitted to the Architect and Engineer (A&E) of the project for review, as part of the product/installer approval process.

1. Proof of Installer qualifications, addressing all requirements of paragraph 1.3 of this specification.
2. Product numbers, specifications, and data sheets for all equipment.
3. The SSI shall submit a point-by-point statement of compliance with all relevant sections defined herein. The statement of compliance shall consist of a list of all numbered paragraphs within these sections. Where the proposed system complies fully with the numbered paragraphs as written, such shall be indicated by placing the word “comply” opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the Installer feels it will accomplish the intent of the paragraph in a manner different from that described, a full description of the intent perceived by the Installer shall be provided as well as a full description of how the proposal will meet its perceived intent. Where a full description is not provided, it shall be assumed that the proposed system does not comply with the paragraph in question. Any submission that does include point-by-point statement of compliance as described herein shall be subject to disqualification from consideration as non-compliant.
4. Data sheets and samples of all labeling materials and equipment to be used in the project.
5. A compete explanation of the identification method to be used for all equipment and cabling part of the Security system.
6. Data sheets of all termination blocks and mounting accessories to be used in the project. A paragraph shall be added before each data sheet indicating the intended use of each type of termination block.
7. Detailed drawings of all custom products to be used in the project.
8. Data sheets for all wire and cable to be used as part of this system. A paragraph shall be added before each data sheet indicating the intended use (to connect what type of devices) of each cable.

B. The second stage of the submittal process is the shop drawing process. Shop drawings shall only be submitted after all portions of the product/installer approval have been accepted by the A&E. The following information is required as part of the shop drawings:

1. Floor plans indicating all devices to be provided and all cable runs to all devices or junction boxes. Devices for alarm systems shall indicate the zone numbers. Access controlled doors shall have the door name/number. All other devices shall have a unique identifier, as they will be programmed in the system.
2. Point to point wiring diagrams indicating all termination points for each conductor and for each device, cable types and color coding of each termination. These diagrams shall be submitted for each door type and for each type of device in the system.
3. Panel schedules in a table format, indicating all ports being used and what device is connected to each port. Panel schedules shall be submitted for all access control panels, alarm panels, fiber optics distribution frames, Ethernet switches, patch panels, termination blocks, etc.
4. Overall system diagrams indicating all head end components, their room location, and all configuration characteristics like IP addresses, serial ports used, etc.
5. Termination details for multi-conductor connectors and other details not included in item 2 of the shop drawings.
6. Outline of the testing process.
7. Training syllabus for each type of training.

C. Equipment quantities are not reviewed by the A&E as part of this submittal approval. Equipment quantities are to be provided by the CI as indicated in the bid documents. Approved shop drawings indicating any changes in equipment quantities or overall scope of work different from the bid documents does not constitute approval by the A&E of these changes. The bid documents and any changes issued by the A&E in the form of Supplemental Information during the construction process are always to be followed for equipment quantities and scope of work.

1.06 ABBREVIATIONS

A. Additional abbreviations used in this document:

1.	ADA	Americans with Disabilities Act
2.	API	Application Programming Interface
3.	ASCII	American Standard Code for Information Interchange
4.	BPS	Bits per Second
5.	DIN	(German Institute of Standardization)
6.	DPS	Door Position Switch
7.	FCC	Federal Communications Commission
8.	GUI	Graphical User Interface
9.	ID	Identification
10.	I/O	Input /Output
11.	ODBC	Open Database Connectivity
12.	O&M	Operations and Maintenance
13.	PIN	Personal Identification Number
14.	PTZ	Pan/Tilt/Zoom
15.	RAID	Redundant Array of Independent Disks
16.	REX	Request to Exit
17.	RoHS	Restriction of Hazardous Substances Directive
18.	SCS	Security Control System
19.	SDRAM	Synchronized Dynamic Random Access Memory
20.	STP	Screened Twisted Pair
21.	UL	Underwriters Laboratories, Inc.
22.	UPS	Uninterrupted Power Supply
23.	USB	Universal Serial Bus
24.	UTP	Unshielded Twisted Pair
25.	VOC	Volatile Organic Compounds

1.07 GLOSSARY OF TERMS

PRODUCT DATA SHEET 1 - The following terms are defined for the purposes of this specification:

1.01 Access Group: A logical group of card readers (terminals) which may be connected to one or more sub-controllers and which represent a collection of readers for which a particular cardholder may have access privileges.

1.02 Access Mode: The mode of operation in which the security control system shall only annunciate tamper and trouble conditions at a monitored point. Alarm conditions shall not be annunciated in this mode. Also referred to as alarm shunting.

1.03 Acknowledge: The action taken by a security control system operator to indicate that he/she is aware of a specific alarm or tamper state.

1.04 Action Messages: A set of instructions automatically provided to the operator when an alarm condition is generated.

1.05 Advisory: A message provided by the security control system to the operator to inform him/her of a condition as reported by the security control system.

1.06 Alarm Condition: A change of state, as sensed by the security control system, indicating that the security control system has detected a condition which its sensors were designed to detect.

1.07 API Integration: a method to transfer information between two systems by means of APIs, though an Ethernet communication network.

1.08 Cardholder: A person who has been issued a valid access card.

1.09 Card Reader: A device usually located at access points, designed to decode the information contained on or within a card key credential for the purposes of making an access decision or for identity verification.

1.10 Clear: The action taken by a security control system operator to respond to an alarm condition or advisory so that other alarms may be serviced or so that other actions may be taken.

1.11 Download: To send computer data from the File Server to a controller for the purposes of making access decision without the intervention of the File Server.

1.12 Facility Code: A coded number, in addition to the individual card number, stored within each card key that uniquely identifies the facility at which the card is valid. This feature prevents cards from one facility from being used at another facility that has a similar access control system.

1.13 File Server: Primary host computer in the networked security system which maintains the access control system database.

1.14 Line Supervision: The monitoring of an electrical circuit via electrical and software systems to verify the electrical integrity of the supervised circuit.

1.15 Off-line: A condition in which a controller(s) is not in communication with the File Server. In the off-line mode, the controller continues to make access decisions and process alarms according to the information stored at its local database.

1.16 Password: A combination of numbers or letters unique to security control system operator which defines commands and data fields he/she may view, edit, or command.

1.17 Relay integration: A method to transfer signals between two systems by means of using potential free contact closures to input points.

1.18 Reset: A command or feedback signal that indicates that a monitored point has returned to its normal state after having transferred to the alarm or trouble state.

1.19 Secure Mode: The normal state of an alarm input point from which it will be monitored for change of state to either an alarm or trouble condition.

1.20 Secured Area: A physical location within the facility to which access is controlled by one or more card readers.

1.21 Secured side: Side of a security door where a higher security level needs to be granted for a user to be authorized to be in that side of the door.

1.22 Serial line integration: A method to transfer information between two systems by means of an RS-232/RS-422 or RS-485 line, using ASCII strings.

1.23 Tamper: A condition within the circuitry of a monitored point which indicates the electrical integrity of that sensing circuit has been compromised.

1.24 Tamper proof screws: A screw with a security hexalobular internal driving feature as described in ISO 10664. As an example, a security TORX head, as developed by Camcar LLC.

1.25 Time Interval: A time stamp of one start time and one stop time within a time period.

1.26 Time Period: A user programmable period of time made up of days of the week and hours in the day.

1.27 Trouble: A condition within the circuitry of a monitored point which indicates that an equipment malfunction, single break, single fault or a wire-to-wire short exists.

1.28 Unsecured side: Side of a security door where a lower security level needs to be granted for a user to be authorized to be in that side of the door.

1.29 User Definable: An attribute of a security control system function that may be easily tailored by the System Administrator.

1.30 Workstation: A personal computer connected to the main security control system File Server via a local area network connection for the purpose of programming the system and responding to alarms.

PART 2: PRODUCTS

2.01 SECURITY MANAGEMENT SYSTEM (SMS)

A. The following Access Control manufacturer has been used for the basis for this design to be compatible with the Owner's existing system. Provide all licensing to ensure that the system is compatible with the existing system.

1. ADT

2.02 SMS FIELD HARDWARE

A. Security Management System (SMS) Hardware: The SMS shall be equipped with the access control field hardware required to receive alarms and administer all access granted or denied decisions. All field hardware must be designed to meet UL 294 requirements. The SMS must be able to retrieve device serial numbers from all field hardware, excluding card readers, biometric readers, and keypads. Depending upon the configuration, the SMS field hardware must be able to include any or all of the following components:

1. Intelligent System Controllers (ISC)
2. Integrated Access and Intrusion System Controller
3. Input Control Module (ICM)
4. Output Control Module (OCM)
5. Single Reader Interface Module (SRI)
6. Dual Reader Interface Module (DRI)
7. Biometric Reader Interface Gateway
8. Access Control Network Door Controllers or Network Controller/Readers
9. Power over Ethernet (PoE) Enabled Door Controller
10. Wireless Gateway Interface
11. Network Adapters
12. Power supplies and enclosures
13. UL, CUL, and CE listed power supplies and enclosures

2.03 SECURITY MANAGEMENT SYSTEM (SMS) DESCRIPTION

A. The Security Management System (SMS) outlined in this section is the key central component for managing physical security and the bridge between physical and logical security for a project. The system shall provide a variety of integral functions including: regulation of access and egress; provision of identification credentials; monitor, track and interface alarms and; view, record and store digital surveillance video linked to SMS events.

B. The SMS shall utilize a single seamlessly integrated relational database for all functions utilizing a fully multi-tasking multi-threading Microsoft Windows Operating System. The SMS shall be written so that all system modules (access control, alarm monitoring, ID or credential management, visitor management, asset management and digital video management) are developed and built from a unified single 64-bit source code set. Separate source code bases for individual modules of the SMS are not acceptable.

C. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator or operator to learn a different and or new interface from the previous version.

D. The SMS shall be compatible with Microsoft Windows, and shall have passed Microsoft-designed tests for compatibility and reliability on Windows 7.

E. The SMS shall be UL 1076 Listed.

F. The SMS shall have FIPS 140-2 certification.

G. The SMS shall only require a single license key to be present on the database server for the SMS to operate. The license key shall either be a physical device or a software license key. The SMS shall allow the SMS USER the ability to activate, return, or repair the software license key. The software license shall only be used on a physical computer or in a VMware virtual environment. License keys shall not be required at the client workstations. The license key on the database server shall determine the number of client workstations that shall be able to connect to the SMS as well as all SMS functionality. An alarm shall be generated in the SMS's Alarm Monitoring application as the license expiration date approaches.

H. The License Administration login and password shall be encrypted when they are passed to the License Server. The hash shall not be the same data even with the same logon credentials on different systems. This is a requirement for U.S. government DIACAP certification.

I. The SMS shall support concurrent licensing with respect to client licenses. CUSTOMER shall purchase a fixed number of client workstation licenses (or connections) that shall be programmed into the database server license file. The SMS shall be installed on any number of client workstations in the CUSTOMER facility. Then, any of the client workstations that have the SMS software installed shall have the ability to connect to the database server as long as the maximum number of concurrent connections purchased has not been reached. Connections shall be licensed on a per module basis. This shall provide CUSTOMER with great flexibility in system design and layout.

J. The SMS shall be able to seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, alarm panels, alarm panel receivers, biometric devices, personal protection devices, intercom systems, fire alarm panels (secondary monitoring only), building management systems and digital video recorders approved for use by the SMS manufacturer.

K. The SMS shall be able to communicate with intelligent system controllers via RS-485, RS-232, TCP/IP or Ethernet.

L. Programming. All programming shall match the existing standards used by the Owner on their existing Genetec system. Submit programming and GUI examples for approval prior to the start of programming.

2.04 COMPONENTS

A. Security Management System (SMS) Software Capabilities: Support an unlimited number of card readers, input points, video cameras, intrusion detection points, and relay outputs. The SMS database server shall support an unlimited number of cardholders, visitors, and assets limited only by the available memory on the ISC. The database server shall also support an unlimited number of system events and System Operator transactions in the history file limited only by available hard disk space. The SMS functions are categorized into nineteen primary "system modules" which shall include:

1. Alarm Monitoring:

   a. The main Alarm Monitoring window shall provide information about the time and location of the alarm, along with its priority. The main Alarm Monitoring window must be able to sort pending and/or insert new alarms based on any of the following attributes: priority, date or time, alarm description, Intelligent System Controller, Card Reader, Input Control Module, asset name, or cardholder. Date or time sorts must be System Operator selectable to be either ascending or descending and must have the option of displaying the seconds of the minute in which the alarm arrived into the SMS. All columns of information in the main Alarm Monitoring window shall be able to be arranged in any order by the System Operator.

   b. The SMS must allow unique emergency instructions to be specified for each type of alarm. It shall also allow for the automatic sending of alphanumeric pages or e-mail messages upon alarm arrival. It shall allow for the sending of alarms to a Central Station. A real-time graphical system status tree on the screen shall indicate if card readers, alarm panels, digital video recorders, video cameras, intrusion detection panels, or Intelligent System Controllers are secured, unsecured, in alarm, or offline. Output control operations must be available to lock, unlock or pulse control points as a standard feature. An automatic cardholder call-up feature shall allow the quick search and display of images in the database. A System Operator journal shall be available to log important daily events. A trace function shall be available for System Operators to locate and track activity on specific cardholders, assets, video cameras, or card readers. An image comparison feature must be provided for use in conjunction with a CCTV interface. All alarms and hardware icons MUST have the ability to control the associated hardware via right-mouse clicks.

2.05 ALARM FORWARDING

A. The security control system shall allow for forwarding of an alarm condition from one destination to an auxiliary or backup destination in the event an alarm is not acknowledged within a predefined period of time.

2.06 ALARM LINKING

A. The Security Control System shall allow any output point within the security control system to be activated based on an alarm condition.

2.07 DOOR POSITION SWITCH (DPS) – BALANCED MAGNETIC SWITCH (BMS)

A. The recessed door position switch shall be provided by the Division 8 door hardware contractor (spec reference: 08710). The Security Systems Installer (SSI) shall provide all wiring to connect this device, coordinate the installation of this component in the door and frame, configure the security system for all monitoring and control of this device.

B. All double doors shall receive (1) magnetic door position switch on each door leaf and shall report as one alarm point.

2.08 WIRE & CABLE

A. All proposed wire and cable shall meet or exceed the recommendations established by the equipment manufacturers, and shall comply with all state and local codes.

B. Visually inspect all wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps.

C. Provide grommets and strain relief materials where necessary to avoid abrasion and excess tension on wire and cable.

D. All penetrations through fire rated barriers shall be provided with appropriate fire stopping materials in accordance with NFPA requirements and local fire authority having jurisdiction.

E. Cables of similar signal level shall be bundled together and kept physically separate from power cords, plug strips or other circuits with different potential. Exposed wire bundles or individual cables shall be neatly secured with self-clinching nylon "TY-Raps" (Thomas & Betts or equal). Lacing of cables shall not be permitted.

F. Manufacturers:

1. Anixter, Inc.
2. Belden Inc.; Electronics Division.
3. Berk-Tek; a Nexans Company.
4. General Cable Technologies Corporation.
5. Mohawk/CDT; a division of Cable Design Technologies.
6. West Penn Wire/CDT; a division of Cable Design Technologies.

G. Plenum-Type, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.

1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

H. RS-485 communications require 2 twisted pairs, with a distance limitation of 4000 feet.

I. Plenum-Type, RS-485 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket.

1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

J. Plenum-Type, Paired Lock Cable: 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.

1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

K. Plenum-Type, Paired Lock Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.

1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

L. Plenum-Type, Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, aluminum foil-polyester tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.

1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

M. Plenum-Type, Paired AC Transformer Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.

1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

2.09 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks, and terminals shall be clearly identified by pre-printed labels or tags. The permanent markings shall clearly indicate the function, source, and destination of all cabling, wire, and terminals. All cables shall be labeled at both ends of the cable with the same and unique identifier label.

B. Cable and equipment identifiers shall follow a standard labeling system like TIA/EIA-606. The identification system chosen by the CI shall be submitted for approval to the A&E.

C. The only approved types of labels for the security system are:

1. Laminated thermal transfer labels printed with a high quality thermal transfer printer.

D. Any type of write-on labels, hand writing on cable jackets, or directly on equipment, labels made with masking tape, or any other type of tape not listed in previous paragraph, is not acceptable and shall be corrected with approved labeling methods at no additional cost to the owner of the project.

PART 3: EXECUTION

3.01 INSTALLATION PRACTICES

A. General: The SSI shall follow all installation practices indicated in specification section 270010.

B. Access control panels and multi-output power supplies shall be installed as to have in any cluster of panels no less than 2 spare ports (reader ports for access control) available per cluster of panels.

C. All power supplies shall be monitored for AC failure. When power supply provides a form c relay with low battery signaling, this contact shall also be monitored. All AC fail and battery low alarms shall be monitored through individual alarm inputs. Series connections of multiple alarm points shall not be allowed.

D. All buzzers inside card readers shall be wired as to function to alert users of different door status like (door held open alarm and door forced open alarm).

E. All local alarms shall be wired with separate wires for the buzzer and for the strobe, so independent use of the strobe and buzzer can be selected by the user.

3.02 WIRING METHODS

A. All proposed wire and cable shall meet or exceed the recommendations established by the equipment manufacturers, and shall comply with all state and local codes.

B. Visually inspect all wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps.

C. Provide grommets and strain relief materials where necessary to avoid abrasion and excess tension on wire and cable.

D. All termination of STP Category type multi pair cables shall be done in Insulation Displacement Connectors (IDC), modular plugs or connectors. The use of wire nuts or manually twisting cables and protecting them with electrical tape are not acceptable means of termination.

E. All cable with gauges larger or equal to AWG-18 and all types of stranded conductors shall be terminated on termination blocks part of an active equipment or in termination blocks supplied by the SSI. The use of wire nuts or manually twisting cables and protecting them with electrical tape are not acceptable means of termination.

F. All termination blocks shall always be mount inside a security enclosure, with a hinged cover and lock. Up to 2 conductors can be terminated in the same point in a termination block as long as the combined diameter of the conductors does not exceed the maximum cable diameter allowed by the termination block. No more than 2 conductors shall be terminated in the same point at a termination block regardless of the cable gauges.

G. Termination blocks shall be used for wire terminations next to access control panels or for termination above the security doors. Termination blocks are not required for connection to security devices at the door side.

H. When equipment supplied has wire leads instead of termination en points for connections, the only acceptable methods of connection to field wiring are insulated butt splices, quick release connectors (both ends provided) or quick lock self stripping pig tail connectors. All connectors or splices shall be selected according to the gauge of the cable to be terminated.

I. All penetrations through fire rated barriers shall be provided, by the SSI, with appropriate fire stopping materials in accordance with NFPA requirements and local fire authority having jurisdiction.

J. All cable runs shall be continuous from the device to the equipment. Cable splices shall not be allowed inside conduits, or cable trays.

K. Cables of similar signal level shall be bundled together and kept physically separate from power cords, plug strips or other circuits with different potential. Exposed wire bundles or individual cables shall be neatly secured with self-clinching nylon "TY-Raps" (Thomas & Betts or equal).

L. All cable runs part of the security system in areas where ceiling is not accessible or in building exterior shall be in conduit at all times.

M. All cables for security equipment shall be installed in conduit to the nearest accessible ceiling space, J-hook to the cable tray and from the cable tray and from the tray to the equipment cabinets. The SSI shall provide all j-hooks to support the cables part of these components.

N. Components of the distribution system shall be installed in a neat, workmanlike manner consistent with all best practices.

O. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the building.

P. Finger duct wire managers shall be used inside all equipment panels to properly dress cables.

3.03 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks, and terminals shall be clearly identified by pre-printed labels or tags. The permanent markings shall clearly indicate the function, source, and destination of all cabling, wire, and terminals. All cables shall be labeled at both ends of the cable with the same and unique identifier label.

B. Cable and equipment identifiers shall follow a standard labeling system like TIA/EIA-606. The identification system chosen by the SSI shall be submitted for approval to the A&E.

C. All access control panels, alarm panels or Intercom exchanges shall include a work sheet attached to the interior of the panel/ equipment in plastic envelops. This work sheet shall include the location, type of device and part number of all devices connected to the boards inside those equipments. All names used to identify devices in these worksheets shall match all names and identifiers used in the software or the user interface of the system. A second copy of this worksheet shall be delivered to as part of the as-built information.

3.04 SYSTEM WARRANTY AND SERVICE

A. General: The SSI shall follow all warranty and service requirements indicated in specification section 270010.

3.05 ENGINEER'S FINAL ACCEPTANCE TEST

A. General: The SSI shall follow all test requirements indicated in specification section 270010.

B. Additional requirements for the system acceptance test:

1. The day of the final acceptance test the SSI shall have at least two (2) 2-way radios to communicate between the testing groups. Cell phones are not acceptable for communication since it takes too long to establish communication, and will delay the test substantially. Radios shall be fully charged, and spare batteries shall be available for 8 hours of use.
2. The final acceptance test will be done with two groups of people. Each group will have at least one member of each stakeholder of the project (A&E, Owner, SSI, General Installer/ Construction Manager). One group will be station in the monitoring room the other group will be going to all locations in the project where security equipment is installed.
3. During the final acceptance test every single device in the security system will be tested for normal operation and for simulated alarm conditions at both ends (the field devices and in the monitoring room). When possible, security equipment will be tested for operation during main power failure. All features requested in this specification will be tested.

C. Testing of all structured cabling system part of the Security System shall be done in accordance of specification section 271000.

3.06 AS-BUILT DOCUMENTS AND CLOSE OUT INFORMATION.

A. General: The SSI shall follow all as built and close out information requirements indicated in specification section 270010

B. Additional requirements for as-built documentation shall include:

1. Approved as-built drawings shall be a complete set of floor plans drawings, riser diagrams, and wiring details indicating the layout and interconnection of the system. All cable routings and elevation of each outlet, tie, and riser cable terminations shall be required.
2. The content of the as-built information shall be no less than the content provided during the shop drawings, and shall be modified as per changes done during construction.

C. Close out information shall also include:

1. Two (2) digital backups of all configuration files and databases part of the security system not earlier than the day after the final acceptance test is approved. These backups shall include a list of all the file names used and a complete description of the system that each file name belong to. The media for these backups shall be a compatible media that can be read by the computer system running the specific software program.
2. Testing reports for structured cabling system used for the Security system.

END OF SECTION 28 10 00