ESSEX COUNTY

Farmworker Housing Renovation

Barn: 82 Loukes Lane
Stables: 10 Marks Road Apartments #1 and #4
Westport NY 12993

PROJECT TECHNICAL SPECIFICATIONS

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Work phases.
3. Work under other contracts.
4. Use of premises.
5. Owner's occupancy requirements.
6. Specification formats and conventions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Essex County Migrant Farmworker Housing

1. Project Location: Westport New York

2. Owner: Essex County
7551 Court Street
Elizabethtown NY 12932

B. Architect: David Cunningham Architecture Planning PLLC
543 Union Street 1C
Brooklyn NY 11215

C. The Work consists of the following:

1. The Work includes rehabilitation of up to three existing buildings that contain residential units and residential support spaces.
Building #1: Barn 25 bed communal living facility
Building #2: Stables two two-bedroom apartments
Building #3: Firehouse three-bedroom dwelling unit on floor 2

D. Lot #1 Barn will have 4 prime contracts

Lot #2 Stables will have 1 prime contract

Lot #3 Firehouse will have 1 prime contract

1.3 WORK PHASES

A. The Work shall be conducted in a single phase.

1.4 USE OF PREMISES

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

B. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. Obtain a Certificate of Occupancy from Town of Essex and Town of Westport.
   2. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
   3. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using CSI/CSC's "MasterFormat" numbering system.

   1. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS

2.1 Manufactures and Models for Specific Products

A. All Manufacturers and Models listed on Material Schedules and Fixture & Appliance Schedules (see Drawings) shall be used and supersede the specifications where a conflict exists. See Section 016000 for alternate submittal procedure.

B. All Manufacturers and Models listed on Window, Door and Glass Schedules (see Drawings) shall be used and supersede the specifications where a conflict exists. See Section 016000 for alternate submittal procedure.

PART 3 - EXECUTION

3.1 Recommended Subcontractors for Specific Contract Work:

END OF SECTION 011000

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Project meetings.
3. Requests for Interpretation (RFIs).

1.2 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.3 COORDINATION

A. Coordination: Contractor to coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

1.4 SUBMITTALS

A. Coordination Drawings: Contractor to prepare Coordination Drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

    a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    b. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 11 by 17 inches but no larger than 36 by 48 inches.
3. Number of Copies: Submit 2 opaque copies of each submittal. Architect will return 1 copy. Provide as electronic submission as well.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
5. Submit coordination drawings to architect / engineer no later than 20 business days prior to commencement of work affected by limited space availability.

1.5 PROJECT MEETINGS

A. General: Contractor to schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Architect to record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Contractor, within 5 working days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

C. Progress Meetings: Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

1.6 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

C. Hard-Copy RFIs: (as per Contractor’s format).

1. Identify each page of attachments with the RFI number and sequential page number.

2. Provide as electronic submission as well.

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow 7 working days for Architect's response for each RFI.

1. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
2. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log biweekly.

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.

7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - MOCK UPS, SHOP DWGS AND SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

B. See Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule.

C. See Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.

D. See Division 01 Section "Closeout Procedures" for submitting warranties.

E. See Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

F. See Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.

G. See Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 MOCK UPS

A. Exterior wall assembly with minimum size of 4’ x 6’. Assembly to include all exterior components including, but not limited to, brick masonry, concrete masonry units, insulation and air barrier typical wall detail at sills, jambs and head lintels windows. Include decorative brick patterns.

B. Sill and metal window trim assemblies.

C. Exterior walkway paving and scoring mock up.

D. Architectural concrete with form liners.

E. Building entry ramps.

F. Exterior tile.

G. Bathroom and kitchen tiling.

H. Finish paint colors for typical apartment.

I. Typical Kitchen + Typical Bathroom for each Project Cluster (2,3). Mock up will be executed in situ and become the finished space once accepted. Mock shall include all floor and wall tile as well as plumbing and lighting fixtures and accessories.

J. Ornamental metal work (security gates + railings).

1.4 REQUIRED SUBMITTALS

See individual Sections for specific submittal requirements. See Mechanical, Plumbing and Electrical Specification Sections for individual section requirements.

A. SUPPORT OF EXCAVATION, SIGNED AND SEALED BY A LICENSED STRUCTURAL ENGINEER

B. CAST IN PLACE CONCRETE

C. STEEL PAN CONCRETE STAIRS

D. STEEL STAIRS, INCLUDING STEEL STRUCTURE DRAWINGS, SIGNED AND SEALED BY A LICENSED STRUCTURAL ENGINEER

E. ELEVATORS

F. WINDOWS AND STOREFRONT DOORS

G. STEEL WINDOW SURROUND HEAD, JAMB AND SILL

H. TYPICAL FLASHING, CAULKING AND WINDOW SEALING

I. ROOFING AT TERRACES

J. BENCHES AT REAR YARDS

K. FLOOR FINISHES

L. PAINT

M. TILE FOR HALLWAY, LOBBY, WALLS AND FLOORS.

N. TILE FOR KITCHENS AND BATHROOMS

O. COUNTERTOPS

P. RESIDENTIAL KITCHEN MILLWORK INSIDE UNITS, EACH KITCHEN TYPE

1.5 SUBMITTAL PROCEDURES

A. Submit a schedule of all submittals for the project, all trades, organized by trade. Indicate which will be drawings, which will be samples, which will be certificates or warrantees.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

a. Project name and Date.
b. Name of Architect.
c. Name of Contractor.
d. Name and address of subcontractor.
e. Name and address of supplier.

f. Name of manufacturer.
g. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.
j. Location(s) where product is to be installed, as appropriate.
k. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal. Provide submittal in electronic format as well.

1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor. Documents may be submitted electronically in digital format.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Furnish as Submitted" or "Furnish as Corrected".

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating "Furnish as Submitted" or "Furnish as Corrected" taken by Architect.

1.6 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

1. In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional(s), the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional(s) who shall be deemed the author of the drawings and data and shall retain all common law, statutory law, and other rights, including copyrights. The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional(s) resulting in any way from any unauthorized changes or reuse of the drawings for any other project by anyone other than the Design Professional(s). In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold harmless the Design Professional(s) from any damage, liability, or cost, including reasonable attorneys' fees arising from any changes made by anyone other than the Design Professional(s) or from any reuse of the drawings and data without the prior written consent of the Design Professional(s). Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. The machine-readable document user understands that the automated conversion of information and data from the systems and formats used by Fulcrum Architecture DPC and David Cunningham Architecture Planning PLLC and its consultants to alternate system or format cannot be accomplished without the introduction of inexactitudes, anomalies, and errors.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Manufacturer's catalog cuts.
    e. Wiring diagrams showing factory-installed wiring.
    f. Printed performance curves.
    g. Operational range diagrams.
    h. Compliance with specified referenced standards.

i. Testing by recognized testing agency.

4. Number of Copies: Submit 3 copies of Product Data, unless otherwise indicated. Architect will return 2 copies. Mark up and retain one returned copy as a Project Record Document. Provide submittal in electronic format as well.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Notation of coordination requirements.
j. Notation of dimensions established by field measurement.
k. Relationship to adjoining construction clearly indicated.
l. Seal and signature of professional engineer if specified.
m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 11 by 17 inches but no larger than 36 by 48 inches.
3. Number of Copies: Submit two opaque (bond) copies of each submittal. Architect will return one copy. Drawings may be submitted electronically in digital format. Provide submittal in electronic format as well.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed. All interior finishes, including but not limited to those listed on the material schedule on A-900, shall be submitted. Sample dimensions shall be 12” x 12” minimum.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit 2 full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit 3 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.

    1. Number of Copies: Submit 3 copies of product schedule or list, unless otherwise indicated. Architect will return 2 copies. Schedule may be submitted electronically in digital format. Provide submittal in electronic format as well.

F. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

G. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design.

    1. Number of Copies: Submit 3 copies of subcontractor list, unless otherwise indicated. Architect will return 2 copies. List may be submitted electronically in digital format. Provide submittal in electronic format as well.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit 2 copies of each submittal, unless otherwise indicated. Architect will not return copies. Provide submittal in electronic format as well.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Statement on condition of substrates and their acceptability for installation of product.
2. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

U. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit 3 copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
1. Furnish as submitted no exceptions taken.
2. Furnish as corrected submit record drawing.
3. Revise and resubmit.
4. Rejected.
5. As per engineer.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. See all Division Sections for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities

having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

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

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

J. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in all Divisions.

1.6 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those

required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA)
CFR	Code of Federal Regulations
CRD	Handbook for Concrete and Cement
FED-STD	Federal Standard (See FS)
FS	Federal Specification
FTMS	Federal Test Method Standard (See FS)
ICC-ES	ICC Evaluation Service, Inc.
NES	National Evaluation Service (See ICC-ES)
UFAS	Uniform Federal Accessibility Standards

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. See all Division Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

C. See Section "Dewatering" for disposal of ground water at Project site.

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner, Architect, testing agencies, and authorities having jurisdiction.

B. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pavement: Comply with Section "Asphalt Paving.", Section "Concrete Paving.", and pavement Sections.

B. Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized steel, chain-link fabric fencing.

C. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

D. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service, unless otherwise indicated.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

E. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities

having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As indicated on Drawings.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

G. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

J. Temporary Partitions:

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.

2. Insulate partitions to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weather strip openings.
6. Provide walk-off mats at each entrance through temporary partition.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. See Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.

C. See all Division Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles. Submit electronic copy as well.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    b. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    c. Samples, where applicable or requested.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

B. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.

5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as per Architect", Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.

6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will

produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION **017419 - CONSTRUCTION WASTE MANAGEMENT + DISPOSAL**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections: 018113 SUSTAINABLE DESIGN REQUIREMENTS

1.2 SUMMARY

A. The inevitable waste that is generated throughout the project shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

B. DIVERSION REQUIREMENTS. A minimum of 75% of total project non-hazardous demolition and construction waste (by weight) shall be diverted from landfill. The following waste categories are likely candidates to be included in the diversion for this project:

1. Land clearing debris, rock and dirt
2. Concrete
3. Bricks
4. Concrete masonry units (CMU)
5. Asphalt
6. Metals (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, brass, bronze)
7. Cardboard, packaging
8. Reuse items indicated on the Drawings and/or elsewhere in the Specification
9. Clean dimensional wood
10. Asphalt for roofing
11. Drywall
12. Carpet and pad
13. Ceiling tiles
14. Glass

1.1 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash debris and rubble resulting from construction,

remodeling repair and demolition operations. Hazardous materials are not included.

C. Diversion from Landfill: To remove, or have removed, from the site for recycling, reuse or salvage, material that might otherwise be sent to a landfill. Diversion from Landfill does not include using the material as alternative daily cover at a landfill site, nor does it include burning, incinerating or thermally destroying waste.
D. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product.
E. Recycle (recycling): To sort, separate, process, treat or reconstitute solid waste and other discarded materials for the purpose of redirecting such materials into the manufacture of useful products. Recycling does not include burning, incinerating or thermally destroying waste.
F. Return: To give back reusable items or unused products to vendors.
G. Reuse: To reuse excess or discarded construction material in some manner on the Project site.
H. Salvage: To remove a waste material from the Project site for resale or reuse.
I. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable and reusable material.
J. Waste Management Plan: A project-related plan for the collection, transportation and disposal of waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material becoming landfill.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 WASTE MANAGEMENT PLAN EXECUTION

A. The Contractor for General Construction Work shall be responsible for the provision of containers and the removal of all waste, non-returned surplus materials, and rubbish from the site. The Contractor for General Construction Work shall oversee and document the results of waste diversion.
B. Record Waste Management Progress Reports: Submit legible copies of weight tickets and receipts from all waste haulers on a monthly basis or as they are received; whichever is more frequent. These receipts shall show the breakdown of materials received and overall percentage of recyclable content based upon that particular load.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. See Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.

14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will proceed with inspection. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit 3 copies of list. Provide as electronic submission as well. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals. Provide as electronic submission as well.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces. Sweep concrete floors broom clean.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces. Remove labels that are not permanent.
j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
k. Wipe surfaces of mechanical and electrical equipment**,** elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Replace parts subject to unusual operating conditions.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017820 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Emergency manuals.
2. Operation manuals for systems, subsystems, and equipment.
3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. See Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS

A. Manual: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, flood, gas leak, water leak, power failure, water outage, equipment failure, and chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.

4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions**,** and demonstration and training videotape if available, that detail essential maintenance procedures:

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

   1. Do not use original Project Record Documents as part of operation and maintenance manuals.

F. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017820

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. See all Division Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit 1 set of marked-up Record Prints. Provide as electronic submission as well.

B. Record Product Data: Submit 1 copy of each Product Data submittal. Provide as electronic submission as well.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2.2 RECORD PRODUCT DATA

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

2.3 MISCELLANEOUS RECORD SUBMITTALS

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

B. Examples of miscellaneous Record Submittals include documentation of foundation depths, special measurements, tests and inspections, surveys, mix records, and inspections by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 018113 - SUSTAINABLE BUILDING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections:
   1. 017419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
   2. 018114 VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS, PRIMERS, AND COATINGS

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with mandatory and optional credits needed.

1. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental performance goals. Specific project goals that may impact this area of work include: use of low-emitting materials; construction waste recycling; and water conserving fixtures, among other criteria. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the stated Sustainable Design.

2. Specific requirements for Sustainable Criteria are included in greater detail in other Sections.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect regarding credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until HPD has made its determination on the project's certification application. Document responses as informational submittals.

1.4 ACTION SUBMITTALS

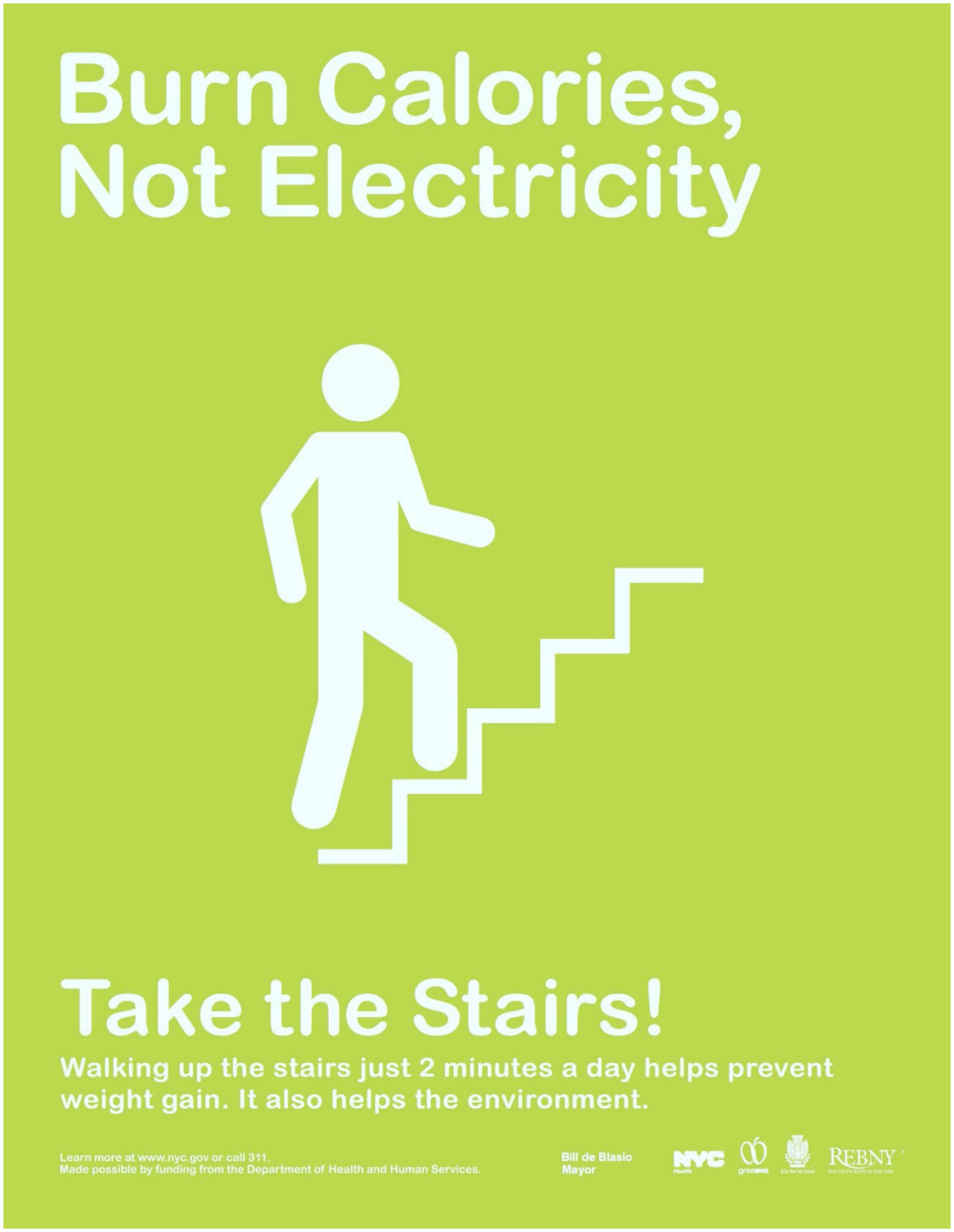
A. General: Submit additional submittals required by other Specification Sections.

B. Submittals providing further clarification for Sustainable Design Requirements may be in addition to other submittals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

A. Place point-of-decision signage at building entrance and corridor intersections to promote stair use for health and other benefits. See example on following page.



END OF SECTION 018113

SECTION 018114 - VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS, PRIMERS, AND COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section includes requirements for volatile organic compound (VOC) content in adhesives, sealants, paints, primers, and coatings used for the project.

B. Related Sections:
   1. 018113 SUSTAINABLE DESIGN REQUIREMENTS
   2. All sections in the Specifications with interior paints and primers
   3. All sections in the Specifications with interior adhesives and sealants and coatings

1.2 REFERENCES

A. GreenSeal Standard 11 (GS-11) for Paints and Coatings, Third Edition August 17, 2011. http://www.greenseal.org/portals/0/documents/standards/gs-11/gs-11_paints_and_coatings_standard.pdf

B. MPI Green Performance Standard (GPS-1-12 and GPS-2-12) for Paints & Coatings, October 2012. http://www.paintinfo.com/GPS/GPS-01%20GPS-2%20Oct%202012.pdf

C. Rule 1168 “Adhesive and Sealant Applications” amended January 7, 2005. South Coast Air Quality Management District (SCAQMD), State of California. http://www.arb.ca.gov/drdb/sc/curhtml/r1168.pdf

D. Regulation 8, Rule 51, of the Bay Area Air Quality Management District (BAAQMD) July 17, 2002. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2008/rg0851.ashx?la=en

1.3 VOC REQUIREMENTS FOR INTERIOR ADHESIVES AND SEALANTS

A. The volatile organic compound (VOC) content of interior adhesives used in this project shall not exceed the limits defined in Rule 1168 – “Adhesive and Sealant Applications” amended January 7, 2005 of the South Coast Air Quality Management District (SCAQMD), of the State of California.

B. The VOC content limits defined by SCAQMD Rule 1168 are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.
   1. General: Unless otherwise specified below, the VOC content of all adhesives shall not be in excess of **250 grams per liter.**

2. For specified building construction related applications, the allowable VOC content is as follows:

Architectural Applications:	
Indoor carpet adhesive	50 g/L
Carpet pad adhesive	50 g/L
Wood Flooring adhesive	100 g/L
Rubber floor adhesive	60 g/L
Subfloor adhesive	50 g/L
Ceramic tile adhesive	65 g/L
VCT and asphalt tile adhesive	50 g/L
Drywall and panel adhesive	50 g/L
Cove base adhesive	50 g/L
Multipurpose construction adhesive	70 g/L
Structural glazing adhesive	100 g/L
Specialty Applications:	
PVC welding	510 g/L
CPVC welding	490 g/L
ABS welding	325 g/L
Plastic cement welding	250 g/L
Adhesive primer for plastic	550 g/L
Contact Adhesive	80 g/L
Special Purpose Contact Adhesive	250 g/L
Adhesive Primer for Traffic Marking Tape	150 g/L
Structural Wood Member Adhesive	140 g/L
Sheet Applied Rubber Lining Operations	850 g/L
Top and Trim Adhesive	250 g/L
Substrate Specific Applications:	
Metal to metal	30 g/L
Plastic foams	50 g/L
Porous material (except wood)	50 g/L
Wood	30 g/L
Fiberglass	89 g/L

C. The volatile organic compound (VOC) content of interior caulks/sealants used in this project shall not exceed the limits defined Regulation 8, Rule 51, of the Bay Area Air Quality Management District (BAAQMD) July 17, 2002.

D. The VOC content limits defined by BAAQMD are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.

Sealant:	
Architectural	250 g/L
Marine Deck	760 g/L
Roadways	250 g/L
Single Ply Roof Material	250 g/L
Non-membrane roof Installation	300 g/L
Other	65 g/L
Sealant Primer:	
Architectural - Nonpourous	250 g/L
Architectural - Pourous	775 g/L
Other	750 g/L

VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS, PRIMERS, AND COATINGS

1. General: Unless otherwise specified below, the VOC content of all adhesives shall not be in excess of **250 grams per liter.**
2. For specified building construction related applications, the allowable VOC content is as follows

1.4 VOC LIMITS FOR INTERIOR PAINTS, PRIMERS, AND COATINGS

A. The volatile organic compound (VOC) content of interior paints and primers used in this project shall not exceed the limits below as defined in GreenSeal Standard 11 (GS-11) for Paints and Coatings, Third Edition August 17, 2011 and MPI Green Performance Standard (GPS-1-12 and GPS-2-12) for Paints & Coatings, October 2012.

Interior Paints and Primers

Flats:	50 g/L
Non-flats:	50 g/L
Floor	100 g/L
Anti-corrosive	250 g/l

B. The volatile organic compound (VOC) content of interior coatings used in this project shall not exceed the limits defined in Rule 1168 – "Adhesive and Sealant Applications" amended January 7, 2005 of the South Coast Air Quality Management District (SCAQMD), of the State of California

Architectural Coatings

Clear Wood Finish: Varnish	275 g/L
Clear Wood Finish: Sanding Sealers	275 g/L
Clear Wood Finish: Lacquer	275 g/L
Stains	250 g/L
Floor Coatings	50 g/L
Water Proofing	100 g/L
Traffic Coatings	100 g/L
Shellac: Clear	730 g/L
Shellac: Pigmented	550 g/L

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 018114

SECTION 018200 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videotapes.

B. See Divisions 2 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training.

D. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools for building managers, superintendents and residents.
8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.
9. Provide owners training on Energy Score Cards for 100% of owner-paid utilities and 15% of tenant-paid utilities for at least 5 years.
10. Provide owners training to collect and monitor project energy and water performance data for at least 5 years for 16-60% of the units.

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish an instructor to describe Owner's operational philosophy.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.2 DEMONSTRATION AND TRAINING VIDEOTAPES

A. General: Engage a qualified commercial photographer to record demonstration and training videotapes. 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.

B. VideoFormat: Provide high-quality video uploaded to web based storage and stored on DVD.

C. Narration: Describe scenes on videotape by audio narration by microphone while] [dubbing audio narration off-site after videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION 018200

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commissioning process requirements for systems, assemblies, and equipment.

B. The following are to be commissioned:
   1. Systems required:
      a. Heating, air handling and distribution, ventilation, and exhaust systems, and their related air quality monitoring systems.
      b. Air, water, and other energy recovery systems.
      c. Manual or automatic controls, whether local or remote, on energy using systems including but not limited to temperature controls, setback sequences, and occupancy based control.
      d. Plumbing, including insulation of piping and associated valves, domestic and process water pumping, and mixing systems.
      e. Mechanical heating systems and service water heating systems.
      f. Refrigeration systems.
      g. Other systems, equipment and components that are used for heating or ventilation and that affect energy use.

1.2 CONTRACTOR'S RESPONSIBILITIES

A. Attend construction & coordination meetings.

B. Provide information requested by the Commissioning Agent (CxA) for commissioning documentation including, but not limited to final approved submittals, start up reports, testing reports, operation and maintenance manuals, as-built drawings and sequences of operations.

C. Provide Testing, Adjusting and Balancing reports to CxA in compliance with Energy Code Requirements

D. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period. Provide necessary measuring locations and test holes, along with approved plugs, as directed by the CxA.

E. For variable refrigerant flow systems provide pressure and vacuum testing procedures to CxA prior to conducting these tests.

F. For variable refrigerant flow systems provide startup report template prior to startup to allow for CxA comments.

G. For variable refrigerant flow systems the manufacturer shall be present during equipment start up.

H. Perform functional commissioning tests at the direction of the CxA.

I. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and operation and maintenance of each piece of equipment, as detailed under Section 3.6 and an Owner's Manual as detailed in section 3.5.

1.3 CxA'S RESPONSIBILITIES

A. Provide Project-specific commissioning process test procedures for actual systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract as needed.

B. Direct commissioning functional testing.

C. Review testing, adjusting, and balancing reports.

D. Provide commissioning test data and inspection reports.

1.4 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. CxA submittal review shall coincide with A/E submittal reviews.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for systems, assemblies, equipment, and components to be verified and tested.
4. Test and inspection reports and certificates.
5. Method of deficiency correction and documentation and communication strategies.

1.5 SUBMITTALS

A. Equipment submittals
1. Manufacturer Product Literature (approved by engineer)
2. Product Installation Instructions
3. Product Operating Manuals

B. Shop Drawings

C. Pressure and vacuum testing procedures

D. Testing reports including, but not limited to pipe pressure/vacuum testing, refrigerant charge calculations, and final refrigerant charge amounts

E. Manufacturers prestart and startup checklists and reports

F. Testing and Balancing Procedures

G. Testing and Balancing Reports

H. Operations and Maintenance Information

I. As-built Drawings, valve tag reports, etc.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

H. Pre-test all systems using the CxA's written Functional Test Procedures.

I. Additional time required from the CxA due to failure to complete all of the preparation outlined above may result in charges to the contractor for additional time spent by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

A. Testing and Balancing must be completed in accordance with NYC ECC section C408.2.2:
   1. Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the New York City Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp (0.74kW), fan speed shall be adjusted to meet design flow conditions.
      a. Exception: Fans with fan motors of 1 hp (0.74 kW) or less are not required to be provided with a means for air balancing.

2. Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or test ports at each side of each pump.
    a. Exceptions:
        1) Pumps with pump motors of 5 hp (3 .7 kW) or less.
        2) Where throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

B. Prior to performance of testing and balancing Work, provide copies of procedures, sample forms, checklists, and certificates to the CxA.

C. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work if necessary.

D. Provide technicians familiar with the installation and location of all components and capable of performing all of the tests outlined in the procedures. Failure to provide appropriate personnel may result in charges to the contractor for additional time spent by the CxA.

E. After submission of final TAB report, the commissioning authority may request to verify select measurements shown on the report. Provide instrumentation, and tools to verify testing and balancing of systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Review Functional Testing Procedures provided by the CxA (to be developed after approved submittals).

B. Provide technicians familiar with the installation and location of all components and capable of performing all of the tests outlined in the procedures. Failure to provide appropriate personnel may result in charges to the contractor for additional time spent by the CxA.

C. Provide instrumentation, tools, and equipment to perform commissioning test at the direction of the CxA.

D. Scope of testing shall include entire installation, from central equipment for heat generation, ventilation and refrigeration through distribution systems to each conditioned space or terminal unit.

E. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

F. The CxA along with the Contractor, testing and balancing Contractor, and Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for systems, subsystems, and equipment.

G. Tests will be performed using design conditions whenever possible.

H. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

I. The CxA may direct that set points be altered when simulating conditions is not practical.

J. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

K. If tests cannot be completed because of a deficiency outside the scope of the system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

L. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing Requirements: The complete testing procedure is outlined in the Commissioning Plan. Specific equipment testing requirements are outlined in the respective test procedures. The following general testing requirements are applicable to all equipment in the commissioning scope:
   1. Prior to prefunctional and functional testing, all static tests related to each piece of equipment shall be completed.
   2. For variable refrigerant flow systems the manufacturer shall be present during equipment start up.
   3. Prefunctional testing:
      a. Shall be performed to ensure proper installation & general functionality of specified equipment. Testing shall be performed by the applicable Contractor or manufacturer's representative. Prefunctional testing procedures shall include, but are not limited to, the following:
         1) Checking all necessary connections and access clearances
         2) Testing of all accessories and associated safety equipment
      b. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to the owner.
         1) If difficulty in correction would delay progress, report deficiency to the CxA immediately.
   4. HVAC and DHW Functional testing:
      a. Shall be performed to ensure full functionality and performance in accordance with design. Functional testing plans will be provided by the CxA and completed by the contractor in the presence of the CxA or designated commissioning

representative. The contractor is responsible for Pre-testing the systems prior to the CxA's arrival to ensure the systems are complete and fully operational. Functional testing can be performed in conjunction with balancing, where approved by the CxA. Functional testing procedures shall include, but are not limited to, the following:

1) Full design load performance (simulated or actual)
2) Part load conditions
3) Control systems related to equipment
4) All modes as described in the sequence of operation;
5) Redundant or automatic back-up mode;
6) Performance of alarms
7) Mode of operation upon a loss of power and restoration of power.
8) Air economizers testing to verify compliance with manufacturer's specifications.

5. Lighting Control Functional Testing
   a. Shall be performed to ensure full functionality and performance in accordance with design. Functional testing plans will be provided by the CxA and completed by the contractor in the presence of the CxA or designated commissioning representative. The contractor is responsible for Pre-testing the systems prior to the CxA's arrival to ensure the systems are complete and fully operational. Functional testing can be performed in conjunction with balancing, where approved by the CxA.
   b. Prior to passing final inspection, the commissioning authority shall provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's instructions.
      1) Where occupant sensor controls are provided, the following procedures shall be performed:
         a) Certify that the occupant sensor has been located and aimed in accordance with manufacturer recommendations.
         b) For projects with seven or fewer occupant sensors, each sensor shall be tested.
         c) For projects with more than seven occupant sensors, testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each unique combination of sensor type and space geometry are provided, not less than 10 percent, but in no case less than one, of each combination shall be tested unless the code official or design professional requires a higher percentage to be tested. Where 30 percent or more of the tested controls fail, all remaining identical combinations shall be tested.
         d) Where occupant sensor controls include status indicators, verify correct operation.
         e) The controlled lights turn off or down to the permitted level within the required time.
         f) For auto-on occupant sensor controls, the lights turn on to the permitted level when an occupant enters the space.
         g) For manual-on occupant sensor controls, the lights turn on only when manually activated.
         h) The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.
      2) Where time-switch controls are provided, the following procedures shall be performed:

a) Confirm that the time-switch control is programmed with accurate weekday, weekend and holiday schedules.
b) Provide documentation to the owner of time-switch controls programming including weekday, weekend, holiday schedules, and set-up and preference program settings.
c) Verify the correct time and date in the time switch.
d) Verify that any battery back-up is installed and energized.
e) Verify that the override time limit is set to not more than 2 hours.
f) In a simulated occupied condition, all lights can be turned on and off by their respective area control switch.
g) In a simulated occupied condition, the switch only operates lighting in the enclosed space in which the switch is located.
h) In a simulated unoccupied condition, nonexempt lighting turns off.
i) In a simulated occupied condition, manual override switch allows only the lights in the enclosed space where the over-ride switch is located to turn on or remain on until the next scheduled shutoff occurs.
j) Additional testing as specified by the registered design professional.

3) Where daylight responsive controls are provided, the following shall be verified:
a) Control devices have been properly located, field calibrated and set for accurate setpoints and threshold light levels.
b) Daylight controlled lighting loads adjust to light level set points in response to available daylight.
c) The locations of calibration adjustment equipment are readily accessible only to authorized personnel.

c. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the CxA will document the deficiency and the Contractor's stated intentions regarding correction in the Issues Log.
1) Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
2) When the deficiency has been corrected, the Contractor notifies the CxA that the item is ready to be re-tested and returns the form to the CxA; the CxA will reschedule the test and the Contractor shall re-test.
3) Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4) Contractor shall bear the cost of Owner and CxA personnel time witnessing re-testing.

3.5 PRELIMINARY COMMISSIONING REPORT

A. A preliminary report of commissioning test procedures and results shall be completed by the commissioning authority and provided to the building owner. The report shall be identified as "Preliminary Commissioning Report".
1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.

2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

B. Buildings, or portions thereof, shall not pass the final DOB mechanical inspection until the code official has received a letter of transmittal from the building owner acknowledging that the building owner or owner's authorized agent has received the Preliminary Commissioning Report. The code official shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review by the code official.

3.6 CLOSE OUT DOCUMENTATION

A. Provide the following documentation to the owner within 90 days of receipt of the first certificate of occupancy:
1. Final As-built drawings including location and performance data on each piece of equipment.
2. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
3. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
4. Name and address of at least one service agency.
5. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
6. Submittal data indicating all selected options for each piece of lighting equipment and lighting controls.
7. Operations and maintenance manuals for each piece of lighting equipment. Required routine maintenance actions, cleaning and recommended relamping shall be clearly identified.
8. A schedule for inspecting and recalibrating lighting controls.
9. A narrative of how each system is intended to operate, including recommended setpoints.
10. Final TAB Report.

B. The commissioning authority shall provide documentation to the building owner within 90 days of receipt of the first certificate of occupancy certifying that the installed lighting controls meet documented performance criteria.

3.7 DEFICIENCY CORRECTION

A. All deficiencies must be corrected within 8 months of the first temporary certificate of occupancy so that the corrections can be verified and the final commissioning report can be submitted to the city as required.

3.8 FINAL COMMISSIONING REPORT

A. Within 18 months of the issuance of certificate of occupancy or letter of completion, the commissioning authority shall prepare a report of test procedures and results, including test

procedures and results performed after occupancy. The report shall be identified as the "Final Commissioning Report".

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance.
    a. Exception: Deferred tests that cannot be performed at the time of report preparation due to climatic conditions.

B. Buildings, or portions thereof, shall not pass the final DOB mechanical inspection until the code official has received a letter of transmittal from the building owner acknowledging that the building owner or owner's authorized agent has received the Preliminary Commissioning Report. The code official shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review by the code official.

END OF SECTION

SECTION 027500 - CONCRETE WALKS AND CURBS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the concrete walks and curbs as shown on the drawings and/or specified herein, including but is not necessarily limited to the following:

1. Concrete curbs and walks.

2. Reinforcement.

3. Joint fillers.

1.3 RELATED SECTIONS

A. Concrete - Section 03300.

1.4 SUBMITTALS

A. Furnish test reports and materials certification as required in Section 03300.

PART 2 - PRODUCTS

2.1 FORMS

A. Provide steel or wood of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

B. Use flexible spring steel forms or laminated boards to form radius bends.

2.2 REINFORCEMENT

A. Provide welded wire mesh conforming to ASTM A185, 6 x 6, ten (10) gauge.

2.3 CONCRETE

A. Concrete Materials

1. Comply with the applicable requirements of Section 03300.

2. All concrete work of this Section shall contain five (5) percent to seven (7) percent entrained air and shall be air entrained with "Air-Mix" air entraining

agent made by Euclid Chemical Company or approved equal made by Master Builders or Grace. Agent shall conform to ASTM C260 and shall be mixed with concrete in accordance with manufacturer's instructions.

B. Concrete Mix, Design and Testing: Comply with applicable requirements of Section 03300 for concrete mix design, sampling and testing, and quality control, and as herein specified. Design the mix to produce standard-weight concrete consisting of Portland cement, aggregate, air-entraining admixture and water to produce the following properties:

1. Compressive Strength: Four-thousand five hundred (4500) psi, minimum at twenty-eight (28) days, with a water cement ratio not to exceed 0.45 by weight.

2. Slump Range: Two (2) inches to four (4) inches.

3. Air Content: Five (5) percent to seven (7) percent.

2.4 JOINT FILLER

A. Gasket: For joint fillers in concrete work, provide closed cell extruded neoprene gasket conforming to ASTM C509, Grade 4, black.

B. Sealant: Where sealant is noted herein to occur above gasket, provide a two (2) part polyurethane sealant complying with Fed. Spec. TT-S-00227, Class B, Type II, self leveling, designed for pedestrian traffic, equal to "HPL" made by Tremco, or approved equal made by Mameco or Pecora.

C. Back-up rod for sealant shall be "Ethafoam" made by Dow Chemical Co. or approved equal.

2.5 CURING

A. Cure concrete with "Super Pliocure" curing compound conforming to ASTM C309 and Fed. Spec. TT-C-800A, modified with thirty (30) percent solids, as manufactured by the Euclid Chemical Company or equal made by Master Builders, Grace or approved equal.

2.6 WATER REDUCING MIXTURE

A. Provide "Eucon WR-75" water reducing and densifying admixture, as manufactured by Euclid Chemical Company or equal made by Master Builders, Grace, or other approved equal. The admixture shall conform to ASTM C494, Type A, and not contain any lignosiliconates nor more than one (1) percent chloride ions.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which concrete walks and curbs are to be installed and correct any conditions detrimental to the proper and timely

completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 SURFACE PREPARATION

A. Remove loose material from the compacted sub-base surface immediately before placing concrete.

B. Proof roll prepared sub-base surface to check for unstable areas and the need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.3 FORM CONSTRUCTION

A. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least twenty-four (24) hours after concrete pavement.

B. Check completed formwork for grade and alignment to the following tolerances:

1. Tops of forms not more than 1/8" in ten (10) feet.

2. Vertical face on longitudinal axis, not more than 1/4" in ten (10) feet.

C. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

3.4 REINFORCEMENT

A. Locate, place, and support reinforcement as specified in Section 03300.

3.5 CONCRETE PLACEMENT

A. Comply with the requirements of Section 03300 for mixing and placing concrete.

B. Do not place concrete until sub-base and forms have been checked for line and grade. Moisten sub-base if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at required finished elevation and alignment.

C. Placing Concrete

1. Place concrete using methods which prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square faced shovels for hand spreading and consolidation.

2. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

CURBS

3. Automatic machine may be used for curb placement. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed the minimums herein specified. Machine placement must produce curbs to the required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

3.6 JOINTS

A. Construct expansion, weakened plane (contraction), and construction joints true to line with face perpendicular to surface of the concrete. Construct transverse joints at right angles to the centerline.

B. Weakened Plane Joints: Provide weakened plane (contraction) joints, sectioning concrete into areas as shown on the Drawings. Construct weakened plane joints for a depth equal to at least 1/4 concrete thickness.

C. Construction Joints: Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such pours terminate at expansion joints. Use standard metal keyway section forms.

D. Expansion Joints

1. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

2. Locate expansion joints at thirty (30) feet o.c. for each pavement lane, unless otherwise indicated.

3. Extend joint fillers full width and depth of joint, and not less than 1/2" or more than one (1) inch below finished surface where joint sealer is required. If no joint sealer required, place top of joint filler 1/8" below finished concrete surface.

4. Furnish joint fillers in one piece lengths for the fill width being placed wherever possible. Where more than one length is required, adhere joint filler sections together.

5. Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

6. Fillers and Sealants: Apply sealant over expansion joint where occupied space occurs below the walk. Comply with the requirements of Section 07900 for preparation of joints and installation, including priming of joints and backer rod.

3.7 CONCRETE FINISHING

A. After consolidating and striking off concrete, level the surface by darbying or bull floating. After the concrete has stiffened sufficiently to permit the operation and the surface sheen has disappeared, the surface shall be floated. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.

B. After floating, test surface for trueness with a ten (10) foot straight edge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing by drawing a fine hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to the Architect.

E. Do not remove forms for twenty-four (24) hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the Architect.

3.8 CURING

A. Protect and cure finished concrete paving, complying with applicable requirements of Section 03300. Use curing compound specified herein applied in accordance with manufacturer's instructions.

3.9 REPAIRS AND PROTECTION

A. Repairs: Where pavement has been cracked or damaged, remove the entire panel wherein the damage occurs and install a new panel of pavement. No patching within a panel is permitted.

B. Protection

1. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least fourteen (14) days after placement. No construction traffic is permitted.

2. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

END OF SECTION 027500

SECTION 027640 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within portland cement concrete pavement.
2. Joints between portland cement concrete and asphalt pavement.

B. Related Sections include the following:
1. Division 2 Section Cement Concrete Paving" for constructing joints in concrete paving.
2. Division 3 Section “Cast-in-Place Concrete for Site Work.”

1.3 SUBMITTALS

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

B. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: To match adjacent pavement color.

2.2 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

2.3 HOT-APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

C. Available Products: Subject to compliance with requirements, hot-applied joint sealants that may be incorporated into the Work include, but are not limited to, the following:

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint- sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

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

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

END OF SECTION 027640

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SECTION 023000 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, pavements, lawns and grasses, and exterior plants.
2. Drainage course for slabs-on-grade.
3. Subbase course for concrete pavements.
4. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."

D. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under footings and foundations, use engineered fill.

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.13 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Shape subbase and base course to required crown elevations and cross-slope grades.
2. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.14 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 023000

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, conditions of the Contract (including General, Supplementary, and Special Conditions), Division 1 Specification Sections and all other Contract Documents apply to work of this Section.

2.1 WORK INCLUDED

A. Extent of cast-in-place concrete is indicated on the Drawings, including layout and sizes of members, type and strength of concrete, reinforcing and accessories.

B. Provide all plants, labor, tools, materials, equipment, appliances, hoists, services and related work as indicated on the Drawings, specified in this Section, and required by job conditions.

C. The work shall include, but not be limited to the following:

1. All cast-in-place concrete, including: Footings, piers, pile caps, mats, slabs on ground, pits, encasement of steel beams and columns, reinforced walls, columns, beams, slabs on steel deck, formed slabs, curbs, parapets, stairs and landings, fill and topping slabs, bases and platforms for equipment, and encasement of conduit.

2. Furnishing, fabrication, and placing of all reinforcing bars, wire mesh, stud rails, reinforcement couplers and reinforcing supports.

3. The design, supply, installation, and removal of all necessary formwork, bracing, shoring and reshoring.

4. Left-in-place metal formwork.

5. All appliances, equipment, scaffolding, runways, chutes, tremies, forms, form coatings, materials and apparatus for placing, protecting, curing and finishing concrete.

6. The proper installation of anchor bolts and other embedded items specified under other sections and other specifications.

7. Grouting of column and beam base plates.

8. Porous fill and vapor barriers under slabs on ground.

9. Waterstops and keys.

10. Expansion, contraction (control), and construction joints.

11. Beam and column pockets, boxed openings, reglets, sleeves, openings, depressions, and the like.

12. Finishing and treatment of exposed concrete floors and stairs, plugging and finishing of form tie holes, and finishing of concrete exposed to view or to receive other materials.

13. Assistance and coordination for quality assurance and quality control.

14. Designing and testing of concrete mixes.

15. Submission of shop drawings, samples, mill certificates and all other supporting data for cement, admixtures, aggregates, reinforcing steel, compounds and other accessories.

16. All other materials labor and services required to complete the work.

3.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals – Division 1 Sections.

B. Shoring and Underpinning – Division 2 Sections.

C. Earthwork - Division 2 Sections.

D. Prestressed Precast Concrete Piles – Section 02360.

E. Augered Pressure Grouted Piles – Section 02370.

F. Precast Concrete – Hollow Core Plank and Double Tees - Section 03400.

G. Precast Concrete – Composite Concrete Deck – Section 03410.

H. Precast Concrete – Keystone Joists and Soffit Beams – Section 03420.

I. Post-Tensioned Concrete – Section 03470.

J. Masonry - Division 4 Sections.

K. Structural Steel - Section 05100.

L. Steel Joists and Joist Girders - Section 05200.

M. Metal Deck and Stud Shear Connectors – Section 05300.

N. Metal Fabrications - Section 05500.

O. Waterproofing – Division 7 Sections.

4.1 CODES AND STANDARDS

A. Conform to the requirements of the New York City Building Code.

B. The following abbreviations are defined for use in this Specification:

1. ACI: American Concrete Institute.

2. ASTM: American Society for Testing and Materials. Specifications cited shall be the latest edition listed in the Index of the Annual Book of ASTM Standards.

3. CRSI: Concrete Reinforcing Steel Institute.

4. AASHTO: American Association of State Highway and Transportation Officials.

C. The most recent version of the following codes, specifications, and standards, conforming to the local building code shall apply to the work. Where conflicts among codes, standards, and specifications exist, the one having the most stringent requirements shall govern. In ACI publications, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears.

1. Building Code Requirements for Structural Concrete, ACI 318-11.

2. Specifications for Structural Concrete, ACI 301-05.

3. Hot Weather Concreting, ACI 305R-10.

4. Standard Specification for Cold Weather Concreting, ACI 306.1-90, Reapproved 2002.

5. Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete, ACI 211.1-91, Reapproved 2002.

6. Standard Practice for Selecting Proportions for Structural Lightweight Concrete, ACI 211.2-98, Reapproved 2004. *

7. Recommended Practice for Evaluation of Strength Test Results of Concrete, ACI 214-77, Reapproved 2002.

8. Guide for Measuring, Mixing, Transporting and Placing Concrete, ACI 304R-00

9. Placing Concrete by Pumping Methods, ACI 304.2R-96, Reapproved 2008.

10. Batching, Mixing, and Job Control of Lightweight Concrete, ACI 304.5R-91, Reapproved 1997.

11. Guide for Consolidation of Concrete, ACI 309R-05.

12. Standard Practice for Curing Concrete, ACI 308R-01.

13. Guide for Concrete Floor and Slab Construction, ACI 302.1R-04.

14. Guide to Cast-In-Place Architectural Concrete Practice, ACI 303R-04.

15. ACI Detailing Manual SP66(04) (Includes ACI 315 and ACI 315R).

16. Standard Tolerances for Concrete Construction and Materials, ACI 117-90, with footnotes referring to buildings over 100 feet in height deleted. Tolerances given in ACI 117 shall apply throughout the full height of the building.

17. Guide to Formwork for Concrete, ACI 347-04.

18. Structural Welding Code - Reinforcing Steel, AWS D1.4-05.

19. CRSI Manual of Standard Practice, 27th edition, 2001, by the Concrete Reinforcing Steel Institute.

20. Standard Specifications for Highway Bridges, 17th Edition, 2002, by AASHTO.

21. Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying, by AASHTO T 318-02-UL.

D. Work of this Section shall conform to all applicable federal, state and local laws and regulations.

5.1 SUBMITTALS

A. Product Data and Samples: Submit samples and manufacturer's specifications and installation instructions for the following products to the Engineer for acceptance prior to the start of any work.

1. Waterstops.

2. Vapor barriers.

3. Joint fillers.

4. Curing, feathering repair and bonding compounds.

5. Non-shrink grout and grout for post-tensioning steel.

6. Admixtures.

7. Synthetic fiber reinforcement.

8. Any other manufactured products specified under Part 2 - Products.

B. Mill Certificates: Submit to Testing Agency and Engineer certified copies of mill test reports for all steel reinforcement, including bars, welded wire fabric, stud rails, prestressing bars and strands.

C. Concrete Mix Designs: Submit proposed concrete mix designs for each type of concrete as required in Part 1.06 - Concrete Mix Design - of this Section for acceptance by the Engineer at least three weeks prior to the start of any concrete work. Reports shall be signed and sealed by a Professional Engineer licensed in the state of New York and experienced in the design and testing of concrete mixes. The reports shall be made on the mix design submittal form included at the end of this specification, or with a similar format.

1. Reports for each mix shall include:

   a. Source and type of each cement, including results of chemical and physical tests, if requested by Engineer.
   b. Complete identification of source of supply for each type of aggregate.
   c. Results of tests of aggregates for compliance with specified requirements, if requested by Engineer.
   d. Scale weight of each aggregate.

e. Absorbed water in each aggregate.

f. Brand, type and amount per cubic yard of each admixture used (including synthetic fiber reinforcement).
g. Amount of free water used per cubic yard.
h. Proportions of each material per cubic yard.
i. Gross weight per cubic foot.
j. Measured slump.
k. Water/cementitious materials ratio, by weight. Submit strength vs. water/cementitious materials ratio curve based upon compressive tests, and indicating water/cementitious materials ratio to be used.
l. Total air content, by percent.
m. Water soluble ion chloride content, percent by weight of cement, if maximum is specified in this Section.
n. Compressive strength at seven and 28 days, from not less than two cylinders at seven days and not less than four at 28 days, for at least four different water/cement ratios.
o. Complete standard deviation analysis or trial mix test data.
p. For mixes with a design strength of more than 4 ksi, results of at least 4 cement cube strength tests.

2. If requested by Engineer, submit manufacturer or supplier's certificates of conformance to applicable standards for each ingredient.

D. Deviations: Requests for deviations from the Drawings or Specifications shall be submitted on Contractor's letterhead. Acceptance of shop drawings including deviations not detected during shop drawing review will not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted by Engineer in writing. Proposed deviations must be accompanied by documented and physical evidence, which will establish that its quality equals or exceeds the quality specified.

E. Shop Drawings: Submit shop drawings to the Engineer for acceptance in accordance with the requirements of the Contract Documents. Engineer shall have two weeks to review submittal packages from day after submittal arrives in Engineer's office until day that submittal is sent returned by Engineer.

1. At least two weeks prior to the first shop drawing submittal Contractor shall provide Engineer with a comprehensive list of all shop drawing submittals, and a schedule indicating when all submittals are to be sent to Engineer. If Contractor deviates from this schedule, Engineer shall be allowed additional time to review shop drawings.

2. Submit shop drawings for:

a. All steel reinforcing bars, welded wire fabric, and stud rails.
b. Pan joist and waffle slab formwork layout.
c. Post-tensioning strands and bars – See Section 03470.
d. Formwork, shoring and reshoring.

3. Shop drawings shall conform to the highest standards of the construction industry. Include enough plans, elevations, sections and details at adequate scale to completely describe all work to be provided. All detailing work shall be

in accordance with ACI 315 and shall be not less complete than examples given in ACI SP-04.

4. Submit shop drawings to Engineer in coordinated packages so that all required information is in hand at time of review. Prior to resubmission of shop drawings, all changes from prior issue shall be clearly circled and identified. Do not fabricate before shop drawings have been reviewed and returned to Contractor marked "No Exceptions Taken" or "Make Corrections Noted" only.

5. Contractor shall coordinate and cross-check for accuracy, completeness and correct relationship to the work of other sections, each shop drawing prepared for the work of this Section, including each shop drawing prepared by accepted subcontractors. Show and dimension holes required for passage of work of other sections through cast-in-place concrete. Engineer's review of shop drawings does not relieve Contractor from these responsibilities.

6. Prior to sending submittals to Engineer, Contractor and Construction Manager (if applicable) shall coordinate and cross-check for accuracy and completeness each shop drawing prepared for work of this Section with the approved Construction Documents and Specifications. Shop drawings shall bear the stamp of Contractor and Construction Manager indicating that this review has been performed. Engineer will not review submittals for which Contractor and Construction Manager have not performed this review.

7. Reinforcing detail drawings shall include, but not be limited to the following:

    a. Setting plans, wall elevations, detailed bending diagrams, cutting lists and other information so as to completely demonstrate the location, spacing, size, length, bending, shape of all reinforcing steel, and position and length of all splices.
    b. The yield strength and ASTM designation of all reinforcing.
    c. All control, expansion and construction joints including keys and waterstops.
    d. Cover for reinforcing, indicated and shown on every shop drawing.
    e. Wall reinforcing detailed on wall elevations, not on plans.
    f. Separate top and bottom bar plans for slabs, with schedules attached. Loose 8.5 x 11 schedules are not allowed.
    g. All openings, depressions, trenches, sleeves, embedded inserts and any other project requirements affecting reinforcing details and placing.
    h. Type, size and location of all metal and plastic accessories required for the proper assembling, placing and support of the reinforcement.

8. Reinforcing steel shop drawings must provide all information, sections, details and marks so that reinforcing steel can be easily placed without the use of any other drawings or information. Reproduction of Structural Drawings, in entirety or part, for use as shop drawing is not permitted.

9. Detail reinforcing steel for curbs, pads, trenches, openings and the like from information given in Architectural, HVAC, Plumbing, Electrical and other Contract Documents.

10. Provide all reinforcement shown or scheduled in the Drawings, including that required by typical details and general notes, but not less than required by ACI

Code minimums.

11. Detailing of reinforcement shall consider the arrangement, shape and size of individual bars, including hooks and lap splices, so as to preclude interference between bars, and embedded items and to provide clear spacing and concrete cover as required by ACI 318. Provide placing sequence information when required to properly install reinforcement in the field. Provide enough sections and enlarged details, whether they are given on Structural Drawings or not, to fully illustrate placement locations.

12. Fieldwork drawings shall be submitted for review of and acceptance for all work required to accommodate field conditions.

13. Submit pan joist and waffle slab formwork layout drawings showing layout, arrangement, widths, depths, tapers, lengths, spacing, blockouts, slopes, and the like.

14. Submit formwork, shoring and reshoring drawings signed and sealed by a Professional Engineer licensed in the State of New York. These drawings will not be reviewed by the Engineer. The submittal requirement is solely to insure that these items have been designed by a licensed Professional Engineer.

F. Protective Measures: Submit hot and cold weather concreting procedures prior to start of any work. Including cold weather heating systems, enclosures, insulation, curing procedures and the like. Procedures shall be reviewed at a preconstruction conference.

6.1 CONCRETE MIX DESIGN:

A. General: Contractor shall employ a consultant, acceptable to the Engineer, hereinafter called the "Concrete Consultant", to prepare concrete mix designs from representative samples of the materials to be used to produce the concrete for each "type" of concrete required.

1. A new "type" of concrete exists whenever any one or more of the following parameters change:

   a. Source or kind of any ingredient.
   b. Type or source of cement.
   c. Design strength.
   d. Proportioning of ingredients.
   e. Placing method (pumping vs. gravity).

2. The Concrete Consultant shall design or verify mixes for each “type” of concrete in accordance with Method II of Section 27-605 of the building code of the City of New York. Submit the results of the following (see Part 1.05) to the Engineer for the approval prior to concreting: Each mix shall clearly state the location where mix is to be used.

   a. Water/cementitious ratio vs. strength curves for each “type” of concrete. Each curve shall be determined by at least four points and each point shall be the average of three strength tests.

3. The proportion of ingredients shall be selected by the Concrete Consultant to produce proper placeability, durability, strength, and to produce a mixture which will work readily into the corners and angles of forms and around reinforcement by methods of placement and consolidation employed on the work, but without permitting materials to segregate or permitting excessive free water to collect on surface. Comply with recommendations of ACI 211.1, 211.2 and 302.1R.

4. When a source, type, kind or brand of each constituent has been established and approved for the project mixes, it shall not be changed throughout the duration of the concreting. Batch all constituents including admixtures at the central batch plant.

B. Admixtures: Concrete mixes with admixture dosages exceeding 64 ounces per cubic yard of concrete shall have free water content of concrete mix reduced by aqueous portion of admixtures in order to adhere to water-to-cementitious ratio requirements.

1. A water-reducing admixture or high-range water reducing admixture shall be used in all mix designs.

2. A high-range, water-reducing admixture shall be used when any of the conditions below apply. Minimum slump shall be 6 inches, maximum slump 10 inches for conventional concrete. Self-Consolidating concrete shall have a slump/flow of 20” to 30”.

   a. Water-to-cementitious ratio is 0.45 or less, architectural concrete, self-consolidating concrete, and synthetic fiber concrete.
   b. Concrete is to be pumped.
   c. When requested by the Contractor and accepted by the Engineer in concrete mix design.

3. An air-entraining admixture shall be used in all mix designs for concrete subject to freezing and thawing.

4. A water-reducing, retarding admixture shall be used when concrete is to be placed during hot weather as defined by ACI 305R.

5. Fly ash shall be used as an admixture for all lightweight concrete to be pumped.

6. A non-corrosive accelerator shall be used when concrete is to be placed during cold weather as defined by ACI 306.1.

7. Synthetic macro fiber reinforcement shall be used where called for on the Drawings and when requested by Contractor and accepted by the Engineer. Unless noted otherwise on the Drawings, or otherwise recommended by the manufacturer, dosage rate shall be 1-1/4 pounds per cubic yard.

C. Mix Requirements: Concrete mixes shall be designed to provide for all of the requirements given in this Specification and on the Drawings even if strength or any other criteria must be exceeded to meet another criteria.

1. Strength requirements given on the Drawings shall be based on 28-day compressive strength for Type I and II cement and 7-day for Type III, unless a different test age is specified.

2. Lightweight concrete shall have a maximum air-dry unit weight as noted on the Drawings, measured in accordance with ASTM C567, a minimum cement content (per cubic yard) of 560 pounds for pump mixes and 520 pounds for other mixes, and a maximum water-to-cement ratio of 0.50 by weight.

3. Normal weight concrete shall have a maximum water-to-cementitious ratio, by weight, of 0.50 and a minimum strength of 4000 psi @ 28 days. *

4. Concrete to be exposed to deicing salts, to brackish water, or to salt laden air in service shall ha1.06.ve a maximum water-to-cement ratio, by weight, of 0.40, a minimum strength of 5000 psi, a minimum cement content of 650 pounds per cubic yard, air entrainment, Type II cement, and a maximum water soluble chloride ion content of 0.15 percent by weight of cement.

5. All concrete required to be watertight shall have a maximum water-to-cement ratio, by weight, of 0.45 and a minimum strength of 4500 psi.

6. All trowel finished interior slabs subjected to vehicular traffic, shall have a maximum water-to-cement ratio, by weight, of 0.53 and a maximum air content of 3% (no air entraining admixture used).

7. Provide pea gravel aggregate concrete for all sections thinner than 6 inches, and where required due to congestion of reinforcing steel.

8. Concrete mixes to be exposed to earth or weather shall have a maximum water soluble chloride ion content of 0.30 percent by weight of cement.

9. All normal weight concrete subject to freezing and thawing shall contain 6% total air content. All light weight concrete shall contain 5% total air content. The allowable tolerance shall be plus or minus 1% of the air content indicated in the mix design.

7.1 INSPECTION AND TESTING

A. General: Owner will engage and pay for the services of an independent Testing Agency acceptable to the Engineer. Agency shall meet the requirements of ASTM C1077 and ASTM E329.

1. Contractor shall be responsible for providing the Testing Agency and Engineer with proper notice of the initiation of each phase and portion of work requiring testing or inspection. Written notice of commencement date shall be provided at least 5 working days prior to the start of shop work and the start of field work. Subsequently, Contractor shall give a minimum of 24 hours verbal notice of work, or completion of work as applicable requiring inspection and/or testing.

2. Contractor shall furnish Testing Agency with the following:

   a. A complete set of all current Construction Documents and Specifications.
   b. A complete set of accepted Shop Drawings.
   c. Cutting, order and shipping lists for reinforcing.
   d. Concrete placing schedules.
   e. Full and ample means and assistance for testing materials and proper facilities for inspection of the work in the mill, shop, batch plant and field.

f. On-site storage facilities complying to ACI and ASTM requirements.

3. Testing Agency may inspect and test materials and work at the source before shipment as well as at the site before, during or at any time after installation. Deficient or incomplete work or materials shall be corrected or replaced, as directed by the Engineer, without additional costs or delays to the Owner.

4. The Testing Agency shall report directly to the Owner and Engineer the results of all testing and inspection by means of daily written reports. When any test or inspection reveals deficient or nonconforming work, Testing Agency shall notify Owner and Engineer immediately by means of a written report specially and clearly marked and identified to show deficient areas of work.

5. Performance or waiving of inspection, testing or surveillance by Testing Agency for a given portion of the work will not relieve Contractor from responsibility to conform strictly to the requirements of the Contract Documents.

6. Where additional tests are deemed necessary by Engineer due to failure to pass tests, the cost of additional testing will be deducted from payments to Contractor.

7. If, due to errors by the contractor or failure to perform his work in accordance with the Contract Documents, the Engineer must perform additional design or drafting work or review proposed solutions, the Contractor shall, through the Owner, reimburse the Engineer in accordance with the Engineer's current fee schedule, plus out of pocket expenses incurred.

B. Inspection and Control: Testing Agency shall perform inspecting and control as required by the New York City Building Code, and as specified herein. Services shall include, but not be limited to:

1. Control of concrete at the batching plant, including tests of materials for moisture, gradation and cleanliness; and determination and recording of all mixture quantities and water/cement ratios. Verify that quantities and materials conform to the accepted trial mixes, adjusted for moisture content of aggregates.

2. Inspection of all reinforcing; verifying size, number, spacing, location, splices, support, wiring, etc. of all reinforcing bars, mesh, and stud rails. The location and installation details of reinforcing and prestressing steel shall be inspected for compliance with the approved Construction Documents and ACI 318. Inspections shall be made only with shop drawings bearing the Engineer's stamp and marked "No Exception Taken" or "Make Corrections Noted" only.

3. Verification of sizes and thickness of structural members, such as slab and wall thickness, beam and column dimensions, etc. Layout, alignment, plumbness, etc. are the sole responsibility of the Contractor.

4. Inspection of all concrete placing, finishing, and curing operations. Testing Agency shall verify that all concrete forms and reinforcing are clean and free of dirt and debris at time of pour and that concrete is properly deposited,

consolidated, finished and cured.

5. Placement and location of embedded items such as sleeves, inserts, railings, etc. is the responsibility of the Contractor and Construction Manager.

C. Testing: Testing Agency shall perform tests as follows for the entire duration of work. Methods of tests shall in all cases comply in detail with latest applicable ACI and ASTM requirements and the New York City Building Code Tests shall be made by an ACI Concrete Field Testing Technician Grade 1 or equivalent.

1. General: Sampling of fresh concrete shall comply with ASTM C172. Shall be taken of concrete as specified herein.

2. Slump: Testing shall comply with ASTM C143. Test every time compressive strength cylinders are taken. Perform additional tests when concrete consistency seems to have changed. When a high-range, water reducing admixture is being used, slump tests shall be made before and after the admixture is added. The results of such tests shall be included in the Testing Agency's written reports.

3. Air Content: Testing shall comply with ASTM C173, volumetric method for lightweight or normal weight concrete or ASTM C231, pressure method for normal weight concrete. Air content must be verified by unit weight tests. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

4. Concrete Temperature: Test at discharge from every truck when air temperature is 40 degrees F (4 deg C) and below, and when 80 deg F (27 deg C) and above. Otherwise test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

5. Compression Strength Tests: Test cylinders shall be made, taken, cured and tested in accordance with ASTM C172, C31 and C39 as applicable.

   a. Sets of test cylinders shall be taken at the mixer at intervals specified herein. Samples shall be laboratory cured unless otherwise directed by Engineer. Test one cylinder at seven days for information, two at 28 days for acceptance, and one shall be retained for testing at 56 days if required. For concrete with specified strength of 6000 psi or greater, test two cylinders at seven days, three at 28 days, and three shall be retained for testing at 56 days. In addition, when intermediate conveyance is be used to place the concrete, one additional set of cylinders shall be taken for each 150 cubic yards or fraction thereof for each type of concrete placed in any one day’s concreting. These test cylinders shall be separate and distinct from those made in the mixer and shall be made in the same batch and cured and tested in the same manner as the samples taken from the mixer.
   b. Cylinder sets shall be taken for each type of concrete poured each day, but not less than one set for each 50 cubic yards, nor less than one set for each 5000 square feet of surface area for walls or slabs. Additional sets shall be taken when requested by Engineer.
   c. When frequency given above would provide less than five cylinder sets for

a given type of concrete, sets shall be made from at least five randomly selected trucks or from each truck if fewer than five trucks are used.

d. Strength level of concrete will be considered satisfactory if the average of any three consecutive strength tests representing each type of concrete equals or exceeds the specified strength, and not more than 10% of the strength tests have values less than the specified strength, and no test shall show an average of less than 85% of the specified strength. A strength test is the average of three cylinders tested at the design age of the concrete.

e. Test reports shall include name of Testing Agency and project, date of concrete placement, type of concrete, exact location of concrete batch in structure and results of seven and 28 day tests and shall be specially marked to clearly identify any and all results falling below specified strength.

f. Additional tests may be performed by the Testing Agency on in-place concrete if compressive tests or inspection or observation by Engineer reveals nonconforming work or practices. Cored cylinders complying with ASTM C42 or other methods directed by Engineer may be used. Contractor shall pay for such tests.

g. If tests indicated unsatisfactory strength, as defined above, one core complying with ASTM C42 shall be taken for each strength test falling below the design strength. Such cores shall be subject to petrographic and chemical analyses.

6. Grout shall be tested for compressive strength in accordance with ASTM C1107. Nine 2 inch cubes shall be taken each day grout is being placed and 3 cubes tested at 3, 7 and 28 days. When requested by Engineer, furnish test data indicating grout placed at a fluid consistency achieves 95% bearing under an 18” x 36” base plate.

7. Tests for water soluble ion chloride content shall be made in accordance with ASTM C114 for concrete that has a maximum chloride ion content specified in this Specification. Test every time compressive strength cylinders are taken. The results of such tests shall be included in the Testing Agency's written reports.

8. Cement Cube Strength Tests: For concrete with a design strength of more than 4 ksi, cement samples shall be taken directly from the hopper at the batching plant and tested in accordance with ASTM C109.

   a. Samples shall be taken randomly, in quantities directed by the Engineer, throughout the project at each shipments of bulk cement and at additional times as directed by the Engineer.

9. Microwave Testing: Test water / cementitious materials ratio with Microwave test per AASHTO T318 as directed by Engineer. Tests to be performed daily during placement of parking decks and ramps and other concrete with a w/cm of 0.40 or less. *

8.1 QUALITY CONTROL

A. General: Contractor shall examine all Contract Documents and note any discrepancies and special construction problems requiring close coordination and

exact time schedules; assume the responsibility of same and administer action such that the proper solution will result.

1. Contractor's material control procedures shall be effective and shall assure that all work fulfills the requirements of applicable provisions of the Contract Documents.

2. Contractor shall maintain, on staff, sufficient office, field engineering, and field supervision staff to assure that all data and layout drawings for work of other Sections is transmitted to detailers to allow proper detailing of holes, penetrations, chases, and the like and to assure proper execution of the work in the field.

3. Perform quality control functions required to achieve and to document that work conforms to the Contract Documents. Provide access to Contractor's quality control documents and reports upon request of Owner, Engineer, Architect or Testing Agency. Provide reasonable numbers of photocopies of specific quality control reports on request.

4. Contractor and Construction Manager shall coordinate and schedule the work of this Section with the work of other Sections of this Specification in order to optimize quality and to avoid delay in overall job progress.

5. Prior to starting applicable phases of the work of this Section (i.e., shop drawings, formwork, reinforcing steel fabrication and placement, concrete placement, etc.), Contractor shall cooperate and coordinate with each trade affected by the work of this Section, including areas where work of other Specification Sections joins or relates to work of this Section. Contractor shall report unsatisfactory or nonconforming conditions to Engineer in writing prior to the start of work.

6. Construction loads shall not exceed the superimposed load, which the member, with necessary supplemental support, is capable of carrying safely and without damage. The amount, method of distribution, and proposed supplemental support of loads during construction shall be the sole responsibility of the Contractor.

B. Qualifications: Throughout the progress of the work of this section, provide at least one person who shall be thoroughly familiar with the Construction Documents and other applicable specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.

1. In actual installation of the work of this Section, use adequate numbers of skilled workmen to ensure installation in strict accordance with the approved design.

2. In acceptance or rejection of work performed under this Section, no allowance will be made for the lack of skill on the part of workmen.

C. Formwork Design: Design and engineering of formwork, as well as its construction and inspection, shall be the sole responsibility of the Contractor.

1. Design, construct, erect, support, brace, maintain and remove forms in

conformance with the requirements of ACI 318, Chapter 6 and ACI 347R for loads, lateral pressure, and allowable stresses, in addition to other design parameters such as wind loads.

2. All forms shall be sound, clean and sturdy enough to maintain true planes as shown on the Drawings, within the tolerances recommended in ACI 117 and as specified herein.

D. Cold Weather: When casting concrete in cold weather, plans to protect the concrete from freezing shall be made in advance and shall be in accordance with ACI 306.1. All materials and equipment to protect the concrete shall be on site before the first frost is likely to occur, not after the concrete has been placed. The Contractor is responsible for ensuring the proper planning for cold weather concreting.

9.1 MEASUREMENTS AND TOLERANCES

A. Measurements: Lay out each part of the work in strict accordance with the Contract Documents. Precise measurements and layout are the sole responsibility of the Contractor.

B. Obtain all field measurements required for proper detailing, fabrication and installation of the work. Field verify all dimensions and locations of existing conditions shown on the Contract Documents. Where discrepancies exist, notify Engineer in writing, and by sketch when applicable, of discrepancies and proposed solutions to correct discrepancies.

C. Tolerances for Slab Finishes: Refer to Part 3 of this specification for requirements.

D. Tolerances for Formed Surfaces: Unless otherwise specified or noted on the Drawings, conform to the requirements given below or as given in ACI 117, whichever is more stringent. All tolerances shall apply to the full height of the building. Variations from grade shall be measured prior to removal of formwork.

1. Variation from plumb:

   a. In the lines and surfaces of columns, piers, walls, corners and the like:
      i) In any 10 ft. of length 1/4 in.
      ii) Maximum for the entire height 1 in.
   b. For exposed corner columns, control-joint grooves, and other conspicuous lines:
      i) In any 20 ft. of length 1/4 in.
      ii) Maximum for the entire height 1/2 in.

2. Alignment:

   a. At slab and/or beam, alignment of columns or walls above and below:
      i) Maximum offset 1/4 in.

3. Variation from level or specified grades and elevations:

   a. In slab, beam and girder soffits and the like:
      i) In any 10 ft. length 1/4 in.
      ii) In any bay or in any 20 ft. length 3/8 in.
      iii) Maximum for the entire length 3/4 in.

b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
   i) In any bay or in 20 ft. length 1/4 in.
   ii) Maximum for the entire length 1/2 in.

4. Variation of building lines from theoretical positions in plan and related positions of columns, walls, piers and the like:

   i) In any bay 1/4 in.
   ii) In any 20 ft. length 1/4 in.
   iii) Maximum for the entire length 1/2 in.

5. Sleeves, wall openings and floor openings:

   i) Variation in size 1/4 in.
   ii) Variation in location 1/2 in.

6. Variation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:

   i) Minus 1/4 in.
   ii) Plus 1/2 in.

7. Variation in the location of anchors and inserts shown in accepted shop drawings, unless more stringent tolerances are required for work of other Sections:

   i) Vertically 3/8 in.
   ii) Horizontally 1/4 in.

8. Faces of formed slab edges, turned down spandrels, and parapets shall not deviate from theoretical position or alignment by more than the distance in consideration divided by 500 or by 1/2 inch, whichever is less.

9. Footings:

   a. Variations in dimensions in plan:
      i) Minus 1/2 in.
      ii) Plus 2 in.
   b. Misplacement or eccentricity:
      i) 2 percent of the footing width in direction of misplacement but not more than 2 in.
   c. Thickness:
      i) Decrease in specified thickness 5 percent
      ii) Increase in specified thickness No limit
   d. Elevation at steel bearing plates:
      i) Plus 1/4 in.
      ii) Minus 1/4 in.

10. Variation in stair dimensions:

    a. In a flight of stairs:
       i) Rise 1/8 in.
       ii) Run 1/4 in.

b. In consecutive steps:
   i) Riser 1/16 in.
   ii) Tread 1/8 in.

E. Fabricating and Placing Tolerances for Reinforcement: Bars used for concrete reinforcement shall be fabricated in accordance with the fabricating tolerances given in ACI 315 and placed in accordance with tolerances given in ACI 318, Chapter 7, or provided herein, whichever is more stringent.

1. Bars shall be placed to the following tolerances:

   a. Clear distance to formed surfaces: ± 1/4 in.
   b. Minimum spacing between bars: ± 1/4 in.
   c. Top bars in slabs and beams:
      i) Members 8 in. deep or less: ± 1/4 in.
      ii) Members more than 8 in. but not over 2 feet deep: ± 1/2 in.
   d. Crosswise of members: spaced evenly within 2 in.
   e. Lengthwise of members: ± 2 in.

2. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to acceptance by the Engineer.

10.1 PROJECT SITE CONDITIONS

A. The Contractor shall report in writing to the Engineer any discrepancies between the design drawings and the existing site conditions.

B. The Contractor shall field verify all information related to existing conditions such as: Surrounding structures, underground utilities and any other conditions that may exist.

C. The Contractor shall survey surrounding structures to obtain information such as: Elevation of existing footings, bearing walls, water supply, sewage, utility piping and other utilities installations which may interfere with the construction.

D. The Contractor shall obtain the pertaining information described above before starting a particular phase of work.

E. Examine the substrata and the conditions under which the concrete is to be installed and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until the unsatisfactory conditions have been corrected.

F. All concrete work shall be properly protected during casting against freezing, excessive heat, acid rain or any other environmental destructive agent. Completed work shall be covered temporarily, permanently or as required. Protect adjacent finish materials against spatter during concrete placing.

G. The Contractor shall comply with any and all federal, state and local environmental code requirements.

H. Descriptions of, or limitations on, sequences of construction given in the Contract Documents are intended to assist the Contractor. Descriptions or limitations given

are not by any means intended to fully describe construction limitations, sequence or techniques, nor preclude use of other methods if accepted by Engineer in writing. Whether or not Contractor follows the limitations and descriptions given herein, Contractor remains fully responsible for both the stability and the safety of the work; adherence to the limitations described herein does not relieve the Contractor from that responsibility.

11.1 DELIVERIES, STORAGE AND HANDLING:

A. Materials and products shall be delivered to the site in the manufacturer's original and unopened containers and packaging bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to accepted samples.

B. Materials and products shall be handled in a workmanship like manner per manufacturer's specifications. Storage shall be under cover in dry, weathertight, ventilated and clean locations off the ground.

C. Protect reinforcing steel and mesh from scaling, oil, grease and distortion. Reinforcing steel and mesh that has rusted to the extent of scaling will be rejected and may be placed in the work only after proper cleaning and approval by the Testing Agency.

D. Storage of ingredients for concrete:

1. Cement shall be stored in weathertight containers.

2. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. To ensure that this condition is met, any test for determining conformance to requirements for cleanliness and grading shall be performed on samples secured from the aggregates at the point of batching. Frozen or partially frozen aggregates shall not be used.

3. Stockpiles of natural or manufactured sand shall be allowed to drain to ensure a relatively uniform moisture content throughout the stockpile.

4. Unless predampening is not considered desirable by the manufacturer or is considered impractical by the Engineer, dry lightweight aggregates shall be predampened as necessary. To prevent excessive variations in moisture content, predampened aggregates shall be allowed to remain in the stockpiles for a minimum of 12 hours before use.

5. Admixtures shall be stored in a manner that will avoid contamination, evaporation, or damage. For admixtures used in the form of suspensions or nonstable solutions, agitating equipment shall be provided to ensure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

E. Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with acceptable materials.

12.1 DEFICIENT WORK

A. Deficient work or any work failing to strictly conform to the Contract Documents shall be removed and replaced, or repaired if accepted by Engineer, at no cost to the Owner, Architect or Engineer.

1. Contractor shall prepare appropriate details and procedures to bring such work into conformance with the Contract Documents and submit to Engineer for review and acceptance. Contractor shall, through the Owner, reimburse the Engineer for time and expense incurred reviewing proposal procedures and details in accordance with the Engineer's current fee schedule.

2. Nonconforming work may be rejected by Owner, Architect or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspection, inclusion in inspection or test reports, or inclusions in certificates of payments.

B. Deficient work shall include, but not be limited to:

1. Low cylinder strength, as defined by this Specification.

2. Excessive or deficient air content.

3. Slump not in accordance with this Specification.

4. Spalling, honeycombing, surface defects, cracking, improper consolidation or the like.

5. Unauthorized cutting, construction joints, cold joints and so forth.

6. Workmanship not in accordance with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.

7. Incorrect forming, finishing or treating of concrete surfaces.

8. Exceedance of tolerances.

9. Evidence of improper curing and the like.

10. Higher than specified water content and/or w/cm ratio as determined by Microwave testing.

PART 2 PRODUCTS

1.1 CONCRETE INGREDIENTS

A. Cement: Portland cement conforming to ASTM C150, Type I or II, from a single supplier.

1. For concrete mixes with a design strength of more than 4 ksi, cement shall have a minimum 28-day cube strength of 4000 psi when tested in accordance with ASTM C109. Refer to Table 2A of ASTM C150.

2. Cementitious material must contain slag and/or fly ash as appropriate to reduce the amount of Portland cement. Limits shall not exceed those indicated in the Building Code.

B. Aggregates: All aggregates shall conform to ASTM C33 for normal weight concrete or ASTM C330 for lightweight concrete. Aggregates for slabs on ground shall conform to the recommendations of ACI 302.1R, Chapter 4. Aggregates shall be suitably graded.

1. Fine Aggregate: Clean, hard, light colored sand.

2. Coarse Aggregate: Sound gravel or crushed stone, having clean, uncoated, hard and strong particles and free of deleterious materials such as alkali, acidic or organic matter. ASTM C33 size #67 or smaller.

3. Lightweight Coarse Aggregate: Rotary kiln product of expanded shale or slate and conforming also to all requirements for normal weight coarse aggregates. For pump mixes, lightweight aggregate shall be purchased from the supplier pre-saturated.

4. Pea Gravel Aggregate: Aggregates shall be as given above, except that coarse aggregate shall be ASTM C33 size #8.

C. Water: Clean, fresh, potable and free from deleterious materials.

D. Admixtures: Concrete admixtures shall improve concrete properties, including desired setting characteristics, and shall be used in accordance with manufacturer's recommendations. All admixtures shall be added at separate intervals of mix cycle.

1. The following admixtures (or equivalents accepted by Engineer) shall be permitted:

a. Air-entraining, conforming to ASTM C-260; “Air-Mix” or “AEA-92” by the Euclid Chemical Company, “Daravair-M” by W.R. Grace & Co., or “MB-VR” or “MBAE-90” by BASF The Chemical Company, “SikaControl AIR-160”, “SikaAEA-14”, “Sika Air” by Sika Company
b. Water-reducing, conforming to ASTM C-494 Type A; “Eucon NW” or “Eucon WR-91” by the Euclid Chemical Company, “WRDA-64” or “WRDA-79” by W.R. Grace & Co., or “Pozzolith N” by BASF Admixture Systems, “Sika Plastocrete” by Sika Company.
c. Non-chloride and non-corrosive accelerator conforming to ASTM C-494 Type C; “Accelguard 80/90 or NCA” by the Euclid Chemical Company, “Daraset” by W.R. Grace & Co., or “Pozzutec 20” by BASF Admixture Systems.
d. Water-reducing, retarding conforming to ASTM C-494 Type D; “Eucon Retarder 75 or Eucon DS” by the Euclid Chemical Company, “Daratard-17” by W.R. Grace & Co., or “Pozzolith R” by BASF Admixture Systems.
e. Mid-range water reducing conforming to ASTM C-494 Type A; “Sikament AFM”, “SikaPlast” by Sika Company
f. High-range, water-reducing conforming to ASTM C-494 Type F; “Eucon 37” or “Eucon SPJ” or “Plastol Series” by the Euclid Chemical Company, “Daracem-100” or “AdvaFlow Series” by W.R. Grace & Co., or “Rheobuild 1000” or “Glenium Series” by BASF Admixture Systems, “Sikament” by Sika Company.
g. Strength/Hardening Accelerators conforming to ASTM C-494 Type C; “Sika Rapid”, “Sika Plastocrete”, “SikaSet”by Sika Company
h. Corrosion inhibiting, calcium nitrite based compound; “Eucon CIA” by the

Euclid Chemical Company, “DCI Corrosion Inhibitor” by W.R. Grace & Co., “Rheocrete CNI” by BASF Admixture Systems, “Sika CNI”, “Sika FerroGard-901 S” by Sika Company

i. Shrinkage Reducing Admixture conforming to ASTM C-494 Type S; “SikaControl” by Sika Company

j. Microsilica; “MSA” by the Euclid Chemical Company, “Force 10,000” by W.R. Grace & Co., or “Rheomac SF” by BASF Admixture Systems.

k. Structural Macro Fibers: ASTM C 1116, minimum of 2 inches (50mm) length, aspect ratio of 50 to 90, minimum toughness rating of R10, 50 = 60 (approximate) according to ASTM C 1018. Manufacturer: The Euclid Chemical Company, “Tuf-Strand SF” or W.R. Grace “Strux 90.40”.

l. Fast setting, self-consolidating concrete repair mortar; “EucoRepair SCC Fast” by the Euclid Chemical Company.

E. The use of admixtures containing calcium chloride, thiocyanates or chloride ions in excess of 0.05% by weight of cement is specifically prohibited.

F. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer.

G. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C618, Class F except that maximum carbon content shall not exceed three percent and maximum percentage retained on the #325 screen shall not exceed 25 percent. Fly ash shall be from a single, domestic source.

2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120 may be used up to a maximum of 40% of the total cementitious content.

3. The exact percentages to be used shall be based on a successful test placement onsite.

2.1 REINFORCEMENT MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, deformed, from new billet steel, produced domestically, unless noted otherwise on the drawings. ASTM A706 for welded reinforcement.

B. Welded Wire Fabric: ASTM A185 for sizes less than W4.0 and ASTM A497 for sizes D4.0 and larger unless noted otherwise on the Drawings.

C. Post-Tensioning Tendons: See section 03470.

D. Bar and Mesh Supports: Supports shall be all plastic or have plastic coating extending at least 1/2 inch up from concrete surface. Coating shall be at least 1/8 inch thick at tips.

1. Mesh supports for slabs on ground shall be precast blocks of concrete.

E. Mechanical Tension Splices for Reinforcing Bars: Cadweld Rebar Splices or Lenton Couplers by Erico Products, Inc., BarGrip by BarSplice Products Inc., HRC by Headed Reinforcement Corp., or equivalent accepted by Engineer.

F. Mechanical Compression Splices for Reinforcing Bars: Speed-Sleeve Splices by

Erico Products, Inc. or equivalent accepted by Engineer.

G. Stainless Steel Reinforcing Bars: ASTM A955, Grade 60, deformed, from new billet steel produced domestically, unless noted otherwise on the drawings.

H. Galvanized Reinforcement and Accessories: ASTM A615deformed bars as specified herein Galvanized conforming to ASTM A767 or welded wire fabric, A496 or A497 Galvanized conforming to ASTM A641.

1. Galvanized miscellaneous hardware, such as chairs, tie-wires, bar supports shall conform to ASTM A153.

I. Shear Reinforcement: Stud rails by Decon.

3.1 FORMWORK MATERIALS

A. Form Contact Surfaces:

1. Forms for exposed finish concrete shall be made of plywood, metal, metal-framed plywood faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces. These types of forms shall comply with the U.S. Product Standard PS-1, "A-C or B-B high density overlaid concrete form" Class I.

2. Forms for unexposed finish concrete shall be made of plywood, lumber, metal, or other material acceptable to Engineer and Architect. Provide lumber dressed on at least two edges and one side for tight fit.

3. Joist and waffle slab pans shall conform to standard dimensions and all the requirements of Concrete Reinforcing Steel Institute. Pans shall be in clean, new-like condition and shall be in steel or fiberglass reinforced plastic. Submit to Engineer and Architect for acceptance. End caps shall be provided for joist pans at beams, bridging and special headers if pans are not closed ended.

4. Forms for round columns shall be metal, fiberglass or cardboard, free of horizontal seams and having a smooth, uniform finish. Discontinuities or bulges will not be allowed. Joints shall be tight and flush.

B. Left-In-Place Forms: Galvanized per ASTM A653, coating designation G90, and not less than 20 gage.

C. Formwork Accessories:

1. Form Sealers: Shall be guaranteed by manufacturer to be non-staining and to not impair the bond of paint, waterproofing or other required surface coatings.

a. Sealer for lumber surfaces and plywood edges shall be clear polyurethane.
b. Sealer for board forms shall be penetrating, non-staining and not leave a surface coating.

2. Releasing Agents: Shall be compatible with material or finish to be subsequently applied and free of deleterious effects on final surfaces.

3. Form Oil: Shall not contain castor oil.

4. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to surface nor leave a hole greater than 7/8" in diameter. Ties shall have a minimum capacity of 3000 pounds.

4.1 MISCELLANEOUS MATERIALS AND PRODUCTS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 1/2 by 1-1/4 inch (19 by 25 mm). Provide Cetxo Waterstop RX-101T by Minerals Technologies Inc.

B. Vapor Barrier: Provide vapor barrier which conforms to ASTM E1745, Class A. The membrane shall have a water-vapor transmission rate no greater than 0.008 gr. / ft^2 / Hr. when tested in accordance with ASTM E96. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. The vapor barrier should be placed directly below the slab on ground. Vapor barrier shall be no less than 15 mil thick. Provide Stego Wrap (15 mil) Vapor Barrier by Stego Industries LLC.

C. Granular Fill: Under slabs on ground shall be well a graded run of bank sand and gravel with maximum size of 1-1/2", between 30% and 50% passing a #4 sieve, between 10% and 25% passing a #50 sieve and not more than 5% of particles by weight passing a #200 sieve. Imported material, if required, shall consist of a well graded mixture of sand and durable, hard limestone. The Contractor shall provide laboratory gradation tests (i.e., before and after laboratory compaction tests) and compaction tests (ASTM D 1557) prior to delivery for evaluation and approval by the geotechnical engineer.

D. Gravel or Crushed Stone: Under slabs on ground shall be hard, clean, natural rock, free of dust or other contaminants, and graded to requirements of ASTM C33, size #67.

E. Non-Shrink Grout: Factory premixed grout complying with ASTM C1107 Grade B; Masterflow 928 or Masterflow 713 by BASF Admixture Systems, SikaGrout 212 by Sika Corporation, “NS Grout” by the Euclid Chemical Company or equivalent accepted by Engineer.

1. High Flow Grout: Where high fluidity and/or increased placing time is required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107, “Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-Shrink).” In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 18” x 36” base plate. Provide Hi-Flow Grout by The Euclid Chemical Co. or Masterflow 928 by BASF Admixture Systems. *

F. Bonding Agent: “SBR Latex” by Euclid Chemical Company, Daraweld-C by W.R. Grace & Co. or equivalent accepted by Engineer.

G. Curing Materials: Sheet materials shall conform to ASTM C171 and be non-bleeding and non-staining. Burlap cloth shall be made from jute or kraft and

conform to AASHTO M182, using at least 2 layers.

H. Curing and Sealing Compound: Shall conform to ASTM C309, Type 1 or 1D; with 30% minimum solids content Masterkure-CR by BASF Admixture Systems, Kurez DR Vox by the Euclid Chemical Company, Sonosil by Sonneborn Building Products or equivalent accepted by Engineer.

I. Bond Breaker: Under fill and topping slabs shall be 4 mil thick polyethylene sheet.

J. Styrofoam: Shall conform to ASTM C578, Type VI; Styrofoam 40 High Load by The Dow Chemical Company or equivalent accepted by Engineer.

K. Expansion Dowels: ASTM A36 bars, hot-dipped galvanized and provided with a suitable expansion shield securely positioned and end filled with a readily compressible material assuring adequate expansion space beyond.

L. TFE Slide Bearings: A nominal 1/16” glass filled virgin PTFE. The bonding shall be done in a heated bonding press under a controlled time and pressure. The stainless steel shall be a minimum of 20 ga A240 Type 304 with a surface finish of less than 20 micro inches RMS. Type CSB as manufactured by CONSERV Inc, Fluorgold by Seismic Energy Products, or equivalent accepted by Engineer.

M. Neoprene Pads: Shall conform to AASHTO Standard Specification, Division II, Chapter 18 ASTM D2240, grade 50 Durometer hardness.

N. Premolded Joint Filler: Non-extruding bituminous-type preformed expansion joint filler conforming to ASTM D1751.

O. Expansion Joint Filler: Sponge neoprene, closed cell, ASTM C1056, Grade SCO-11, high performance.

P. Semi Rigid Joint Filler: For contraction and construction joints in slabs on grade a two (2) component 100% solids compound, with a minimum shore A hardness of 80. Provide “Euco 700” or “QWIKjoint 200” by The Euclid Chemical Company or Masterfill CJ by BASF Admixture Systems.

Q. Liquid Sealer Densifier: High performance, deeply penetrating concrete densifier; odorless, colorless, VOC - compliant, non-yellowing siliconate based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum solids content of 20% of which 50% is siliconate. Provide Diamond Hard by The Euclid Chemical Company.

R. Penetrating Sealer: Clear solvent based or water based silane or siloxane penetrating sealer; Euco-Guard 100, 200 or Vox by the Euclid Chemical Company, Sikaguard 701W by Sika, Masterseal SL by BASF Admixture Systems, or equivalent accepted by Engineer.

S. Non-Oxidizing Metallic Floor Hardener: The specified non-oxidizing metallic floor hardener shall be formulated, processed and packaged under stringent quality control at the manufacturer’s owned and controlled factory. The hardener shall be a mixture of specially processed non-rusting aggregate, selected Portland cement and necessary plasticizing agents. Product shall be “Diamond-Plate” by The Euclid

Chemical Co.

T. Polymer Repair Mortar: Polymer and microsilica modified cementitious based compound; “Thin Top Supreme, Concrete Top Supreme” (Horizontal repairs) by the Euclid Chemical or “Sikatop 121 or 122” (Horizontal repairs) by Sika Chemical, or “Verticoat/Verticoat Supreme by The Euclid Chemical Company (Vertical or Overhead) or “Sika 123” by Sika Chemical (Vertical or Overhead) by Sika Chemical. These patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Engineer is required.

U. High Strength Repair Mortar: A flowable high strength, microsilica modified repair mortar for large horizontal placements or form and pour applications; Eucocrete by Euclid Chemical.

V. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound, Eucofloor SL160 by The Euclid Chemical Company, Ardex by Ardex Company, or Underlayment 110, by BASF Admixture Systems.

W. Slab on Ground Plate Dowels: Plate material shall be ASTM A36 steel and shall be Diamond Dowel System, by PNA Construction Technologies, size 1/4” x 4½ ” dowels. Locate plate dowels at construction joints. Do not shear plates. Remove burrs at edges of plates.

X. Contraction Joint Protection: Load plate shall be smooth steel plate bars, ASTM A36, and shall be Load Plate Basket or PD^3 Basket by PNA Construction Technologies. Locate Load Plate Baskets at contraction joints so noted on the plans. Do not shear. Remove burrs. *

PART 3 EXECUTION

1.1 PRE-CONSTRUCTION CONFERENCE

A. At least 35 days prior to the start of concrete construction schedule, the contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The contractor shall send a pre-construction conference agenda to all attendees 20 days prior to the scheduled date of the conference.

2.1 PREPARATION FOR CONSTRUCTION

A. Adjacent Structures: Contractor is solely responsible for the protection, shoring, bracing, stability and underpinning of existing structures either on or adjacent to the site. Details and extent of such work shown on the Drawings are suggestions only; Contractor is to determine requirements and methods. All of the above operations shall be done under the supervision of a qualified Professional Engineer licensed in the state of New York.

B. Examination of Field Conditions: Contractor shall examine all existing surfaces, structures and the like which the work must attach to, clear or abut. Notify Engineer in writing of any conditions, which will delay or be detrimental to work. Start of work shall represent acceptance by Contractor of existing conditions as suitable for completing work as specified.

C. Field Measurements: Contractor shall verify, by measurements at the site, all existing dimensions, which affect the work of this Section. Field dimensions varying from those on the design drawings or accepted shop drawings shall be brought to the Architect's and Engineer's attention in writing.

3.1 FORMWORK

A. General: Contractor shall be solely responsible for the design, construction, erection, removal, safety and adequacy of all concrete formwork, falsework, shoring, reshoring and the like. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied, until such loads can be supported by the concrete structure.

1. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

B. Construction and Erection: Construct forms of correct size, shape, alignment, elevation, and location so as to obtain accurate lines, positions, grades, levels, and plumb work in finished structures. Maintain tolerances required in this Specification.

1. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the work. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

2. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

3. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

4. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.

5. Camber forms as indicated on Drawings and elsewhere as required to achieve level finish surfaces. Camber top surfaces of such locations by setting screeds to follow camber of formwork and maintain uniform thickness. Shape of cambered form surfaces shall be gently curved.

6. Formwork surface materials shall be cleaned thoroughly and repaired prior to reuse. Damaged materials, which cannot be repaired prior to conditions complying with this Specification, shall not be reused. Condition of formwork surfaces, use and reuse shall be subject to acceptance or rejection by Architect or Engineer. Rejected formwork shall be removed from the jobsite immediately.

7. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into

forms.

8. Provide form ties at spacing as required to hold formwork readily and eliminate visible deflection and building of formwork surfaces as well as safely resist all applied loads. Ties shall be coated with an approved bond breaker.

9. Foamglass panels shall be installed with staggered joints and bonded with adhesive approved by manufacturer.

C. Cleaning and Preparation of Forms: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening of forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply form coating compound as specified for new formwork.

1. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

2. Coat contact surfaces of forms with releasing agents and/or form-coating compound before reinforcement is placed.

3. Coat steel forms with a non-staining, rust-preventive form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

4. Do not allow form coating or releasing agents to come in contact with previously placed concrete, reinforcement or embedded items.

D. Concrete Forms Exposed to View: Construct form surfaces only with materials approved by the Architect.

1. Chamfer exposed corners and edges as indicated on architectural drawings, using wood, PVC, rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

2. Provide square exposed corners and edges as indicated on architectural drawings, using wood, metal, or PVC strips fabricated to produce uniform smooth lines and tight edge joints.

3. Locate ties in level and plumb lines and columns in arrangements acceptable to the Architect.

4. Form coating and releasing agents shall not discolor concrete.

E. Form Removal and Reshoring: Forms, shores, or reshores shall be removed only after the concrete has rendered sufficient strength to carry the dead weight of concrete plus all applicable construction and external loads without causing damage, overstress, or excessive or permanent deflection. Comply with recommendations of ACI 347R.

1. Contractor shall be solely responsible for proper and safe removal of forms, shoring, and removal of reshoring. Contractor shall do cost of tests and/or calculations needed to determine such techniques, timing and sequences without expense to Owner, Architect or Engineer.

2. Contractor shall replace or repair, at Engineer's direction, any and all work damaged by improper removal or reshoring operations.

3. Formwork not supporting weight of concrete, such as sides of spandrel beams, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 36 hours after placing concrete, provided that the concrete is sufficiently hard to not be damaged by form removal operations, and that effective curing and protection operations are provided as required by this Specification.

4. Unless reshoring is used, formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than the time period specified in ACI 347, paragraph 3.7.2.3 unless concrete has attained 75 percent of specified compressive strength at an earlier time. Determine compressive strength of in-place concrete by testing field-cured cylinders representative of concrete location or members. The Contractor shall pay the cost of such testing.

5. If reshoring is used, remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the structure without excessive stress or deflection. Removal of reshores shall comply with requirements for removal of forms supporting weight of concrete. Reshores shall extend at least 3 floors and be placed directly below shores for level being placed as to transfer loads directly.

6. Prior to removing reshores, the underside of the slab shall be surveyed to determine the relative elevation of the slab. At a minimum, survey points are to be located next to columns and at center of column strips and middle strips. Slab edges and cantilevers are to be surveyed at points of theoretical maximum and minimum deflections within each span. Surveyor is to submit a general layout of points to engineer for approval prior to surveying the slabs. Additional points may be required at the engineer’s discretion. The Construction Manager is to contract out the surveying service to a surveyor not affiliated with the concrete contractor. The cost of this survey is to be included in the construction cost.

4.1 FABRICATION AND PLACEMENT OF REINFORCEMENT

A. Fabrication: Reinforcing steel shall be fabricated in strict accordance with accepted shop drawings, and standards and tolerances referenced by or given in this Specification. Workmanship shall be of the highest standard of the construction industry using modern equipment and tools in good condition. To the extent practical, fabrication shall be done in the shop and not in the field.

1. Partially embedded reinforcement shall not be bent or re-bent without the express written acceptance of the Engineer. Offset bars shall be bent before being placed.

B. Placement: Placing of reinforcement shall comply with the requirements of the Concrete Reinforcing Steel Institute's (CRSI) recommended practice for "Placing Reinforcing Bars", and as herein specified.

1. Clean reinforcement of loose rust and mill scale, earth, ice and other materials,

which reduce or destroy bond with concrete.

2. Accurately position as shown on accepted shop drawings. Support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

3. Place reinforcement to obtain at least minimum coverages for concrete protection as required. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

4. Reinforcing bar supports shall be appropriate for the intended use and used in sufficient numbers and proper manner to hold reinforcing accurately in position before and during concreting operations.

    a. Neither top nor bottom bars shall be allowed to sag below tolerances specified herein.
    b. For #8 bars and smaller, separate adjacent layers of parallel bars with short length of #8 bars, securely tied to both layers. For #9 bars and larger, separator bar shall be of the largest bar size separated.
    c. Displaced reinforcing steel or embedded items shall be immediately repositioned and secured with additional supports to prevent recurrence.
    d. Reinforcing bars and mesh over metal deck shall be supported and secured prior to concreting operations.

5. Tie wire ends shall not fall within required clear concrete cover.

6. Tack welding of reinforcing steel is prohibited. Replace bars damaged by welding operations. Welding of bar intersections is prohibited.

C. Reinforcement other than uncoated ASTM A615: Shall be subject to the following in addition to all other requirements given in this Specification:

1. Shop-or field-bending of reinforcing bars before or after galvanizing shall pay special attention to the minimum bend diameters required by Table 2 of ASTM A 767.

2. Cold bend all bars around pins with nylon collars and take other required steps to minimize damage of the coating during fabrication. Hot bending will not be permitted.

3. Handling and hoisting shall be done with care, making use of nylon lifting slings. Bundles of bars shall be lifted in a manner to prevent bar-to-bar abrasions; spreaders shall be used to lift bundles where lifting at third points is not practical. Bundling bands shall be padded or shall be nylon.

4. Store bars on padded or wooden cribbing.

5. Reinforcing bars used as support bars for galvanized or stainless steel reinforcement shall also be galvanized or stainless steel.

6. Damage to coating shall be repaired in accord ASTM A780. Bars requiring patching in excess of 2 percent of the surface area of that bar shall be rejected

and shall be removed immediately from the site.

5.1 JOINTS

A. Construction Joints: Shall be made and located only as shown or indicated on the Drawings or accepted shop drawings. Conform to ACI 318, Article 6.4. All construction joints not shown or indicated on the Drawings shall be submitted in writing for acceptance.

1. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings. Accepted bulkheads designed for this purpose may be used for slabs. Use butt joints for unreinforced slabs on grade with Diamond Dowels for proper load transfer.

2. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

3. Provide waterstops in construction joints as indicated on drawings and specifications. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during the progress of work. Fabricate field joints in waterstops in accordance with manufacturer's instructions.

4. Where overlay finishes, such as pavers or terrazzo, are to be provided, locate construction joints accurately below or behind expansion joints in the finish material.

5. Do not exceed maximum distance between construction joints noted in the Drawings or this Specification. If no criteria is given, do not space greater than 40 feet for walls, 100 feet in any direction for formed slabs, or 40 feet for slabs on ground.

6. Do not cast columns higher than 1/2 inch or lower than 1 inch below lowest girder, beam or slab supported by the column.

7. Construction joints designated to be specially roughened, or joints of new concrete connecting to existing concrete, shall be bush hammered to 1/4-inch minimum roughness amplitude and thoroughly cleaned. Apply specified bonding agent where noted or specified.

8. Joints in slabs on grade, subjected to hard wheeled traffic shall be filled with the specified semi-rigid joint filler. The installation shall be made in strict accordance with the instructions from the manufacturer. The surface must be level with the concrete shoulders.

B. Contraction (Control) Joints in Slabs-On-Ground: Construct in pattern as shown or noted on Drawings.

1. Inserts shall be laid into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of inserts. After concrete has cured, remove inserts and clean groove of loose debris.

2. Saw cuts shall be made as soon as possible after slab finishing and may be done without dislodging aggregate.

a. Maximum joint spacing shall be 36 times the slab thickness unless otherwise noted on the drawings. The Soff-Cut saw shall be used immediately after final finishing and to a depth of 1-1/4". A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness.
b. Use load plate baskets under saw cuts where designated on the plans for load transfer.

3. Joints, in slabs on grade, subjected to hard wheeled traffic shall be filled with the specified semi-rigid joint filler. The installation shall be made in strict accordance with the instructions from the manufacturer. The surface must be level with the concrete shoulders.

C. Isolation Joints in Slabs-On-Ground: Provide at points of contact between slabs-on-ground and vertical surfaces where shown or called for on drawings. Provide joint filler and sealant as specified.

D. Expansion Joints: Locate and construct as noted or shown or called for on drawings. Width of joint shall be kept completely free of reinforcing steel, concrete, form materials, conduit, or any other material and shall be cleaned immediately prior to installation of filler.

1. Joint filler shall be installed the full depth of the joint, unless specifically indicated otherwise, and set flush with the exposed concrete surface unless a sealant or reveal is called for.

6.1 INSTALLATION OF EMBEDDED ITEMS

A. Install anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Install sleeves, conduits, box-outs and the like for other trades prior to placing concrete, and where practical, prior to placing reinforcement. Set accurately and securely so as not to displace during subsequent work.

7.1 MIXING AND DELIVERY OF CONCRETE

A. Ready-Mixed Concrete: All concrete shall be ready-mixed. Batch at a central plant, with automatic control and recording devices. Comply with ACI 304R, 304.2R, 304.5R and ASTM C94. Each admixture used shall be added at a different stage of the mix cycle.

1. After the introduction of initial mixing water for the batch, no additional water shall be added from the truck water system or any other source, even if the slump at the job site is less than that specified.

2. High-range, water-reducing admixture shall be added at the jobsite or at the initial batching, in accordance with the manufacturer’s instructions.

3. Synthetic Macro Fiber Reinforcement: Fibers shall be added when concrete is batched. Follow manufacturer’s instructions and standard ASTM C94 practices.

4. Discharge of concrete shall be completed within 1½ hours, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or introduction of the cement to the aggregates.

B. Hand-Mixed Concrete: Shall not be used without written acceptance by Engineer. When permitted, such concrete shall be mixed only in watertight containers. Each ingredient shall be measured dry and sand and cement shall be mixed prior to adding coarse aggregate. Water shall be added slowly so as to provide an even mixture.

8.1 CONCRETE PLACEMENT

A. General: Comply with ACI 304R and ACI 309R and handle with due care to avoid deterioration due to delay or handling.

1. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work; cooperate in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

2. Forms and other surfaces to receive fresh concrete shall be clean and free of frost, dirt and any other debris immediately prior to and during concrete placing.

3. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

4. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as approved by the Engineer.

5. Free drop of concrete shall not exceed 8 feet for columns or 4 feet for other elements. Self-Consolidating Concrete may be dropped further when approved by the engineer. Canvas or rubber elephant trunks may be used to limit free drop.

6. Concrete shall not be placed on frozen subgrade.

7. Should cold joints form, cease operations. Submit detailed drawings showing remedial measures for acceptance. Drilled dowels or anchors or chipped keyways may be required by the Engineer.

8. Deposit concrete as near as practical to its final location. Minimize lateral movement of fresh concrete. Placement procedures shall not allow concrete to drop thru successive reinforcing grids, nor strike cages in columns or layers in walls.

9. Concrete temperature, at time of placing, shall not be less than 50^{o}F nor more than 95^{o}F.

B. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement

consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 in. into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

3. Self-Consolidating Concrete may not require vibration if successful placement is demonstrated on site.

C. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints (if required), until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

D. Weather Limitations: Concrete shall not be placed during rain, sleet or snow, nor shall rain, sleet or snow be permitted to fall upon uncured surfaces.

9.1 MISCELLANEOUS CONCRETE WORK

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

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts complying with equipment shop drawings or templates of manufacturer furnishing machines and equipment. Bases poured on concrete slabs shall be same type of concrete as slab, unless specifically noted otherwise on the Drawings. Foundations shall be normal weight, 4 ksi concrete, unless noted otherwise. Trowel concrete to a smooth, dense finish.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and finish concrete surfaces as scheduled.

D. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners,

intersection, and terminations slightly rounded. If the curb is part of a beam, the form shall be removed as specified in the section for beams.

E. Non-Shrink Grouting: Provide formwork; install flowable non-shrink grout and cure in strict accordance with manufacturer's instructions. Use high flow grout for all base plates larger than 12 sq. ft.

F. Concrete Topping: Clean surface of underlying slab of all oil, dirt, laitance and any other material, which could impair bond. Moisten existing concrete thoroughly prior to placing topping. Use structural macro fibers at 4 lbs. per cubic yard in 4000 psi topping, with a maximum w/cm of 0.50, unless otherwise indicated on the plans. Approved curing procedure must begin immediately after final finishing. The joint pattern must be approved by the engineer. *

10.1 FINISH OF FORMED SURFACES

A. Rough Form Finish: Provide for formed concrete surfaces not exposed to view and not covered with a material applied directly to the concrete.

1. This is a concrete surface having texture impacted by the form facing material used, with tie holes and defective areas repaired, filled and patched. Fins and other projections exceeding 1/4 inch in height shall be rubbed down or chipped off.

B. Smooth Form Finish: Provide for formed concrete surfaces exposed to view, or that are to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system.

1. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas. Fins or other projections shall be completely removed.

C. Grout-Cleaned Finish: Provide, where scheduled, to concrete surfaces, which have received smooth form finish.

1. Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

D. Architectural Concrete Finish: Provide smooth, uniform finish upon form removal with no patching, stoning, or other form of repair, except washing, permitted unless otherwise noted, for walls, columns, and other surfaces visible to view when the work is complete. Use Self-Consolidating Concrete. The surface shall match the approved jobsite mockup panel.

E. Related Unformed Finishes: At top of walls, horizontal offsets, and similar unformed

surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

11.1 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

1. After placing slabs, plane surface to tolerances for floor flatness (F_F) of 15 and floor levelness (F_L) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

B. Float Finish: Apply to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F_F 18 - F_L 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply to monolithic slab surfaces that are to be to exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surfaces by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F_F 20 - F_L 17. Grind smooth surface defects, which would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately following score surface by fine brooming.

E. Non-Slip Aggregate Finish: Apply to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.

1. After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

2. After curing, lightly work with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate.

3. Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material at right angles to first application, and embed by power floating.

4. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

F. Non-oxidizing Metallic Floor Hardener: All slabs, in the loading dock area, or other areas noted on the drawings, shall receive an application of the non-oxidizing, metallic floor hardener applied at the rate of 1.5 lbs/ft5. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the required weight of the non-oxidizing metallic floor hardener over the concrete surface, by mechanical spreader, and embed by means of power floating. The hardener shall be floated in and the second application made. The surface shall be floated again to properly bond the hardener to the base concrete slab. The surface shall then be troweled, at least twice, to a smooth dense finish.

1. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by hardener manufacturer. Apply curing compound immediately after final finishing.

G. Architectural Finish Concrete Floors: Where called out on Architectural Drawings, provide special concrete floor finishes as required. Review requirements at preconcreting conference including mock up requirements, staining, embeds etc. Do not proceed until approval of mock up by Architect.

12.1 CURING, TREATMENT AND PROTECTION

A. General: Comply with all applicable recommendations of ACI 308, "Recommended Practices for Curing Concrete", and all requirements of this Specification.

1. Protect freshly placed concrete from rain, premature drying, and excessive hot or cold temperature.

2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

3. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days, at a temperature of at least 50°F, in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

4. Comply with specified requirements given in other paragraphs of this Specification for hot or cold weather concreting, as defined by ACI 305R and 306.1.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by

moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified.

1. Provide moisture curing by one of the following methods:

    a. Keep concrete surface continuously wet by covering with water.
    b. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:

    a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing and sealing compound as follows:

    a. All exposed interior slabs, not receiving a liquid densifier, and troweled slabs receiving mastic applied adhesives or “shake-on” hardeners shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and architectural concrete, not receiving a penetrating sealer, shall be cured with the specified curing and sealing compound. Maximum coverage shall be 400 ft5/gallon on steel troweled surfaces and 300 ft5/gallon on floated or broomed surfaces for curing/sealing compound.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by one of the methods specified above, as applicable.

D. Curing Unformed Surfaces:

1. Apply curing and sealing compound to all slabs, ramps, pit slabs, stairs, landings and the like, except where bond and adhesion of mortar, adhesive or other finish material will be adversely affected.

2. Treat slabs, ramps, curbs and columns and walls two feet up from top of slabs with penetrating sealer in areas that will be exposed to deicing salts in service. Follow manufacturer's instructions for dosage and procedures.

3. Cure other areas by moist cure, or moisture-retaining cover, or strippable curing compound.

E. Surface Treatments:

1. Penetrating Sealer: Apply at a rate of 125 square feet per gallon. Sweep and power wash concrete surface before application. Do not apply until time period specified in manufacturer’s instructions.

13.1 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms.

1. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect or Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

1. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, but without exposing the reinforcing.

3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use the specified underlayment or repair topping.

4. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete.

Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

5. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

14.1 CONCRETE STRUCTURAL REPAIRS

A. Perform structural repairs only where accepted, by Architect, Owner and Engineer, in detailed procedure submitted by Contractor in writing. All other defective areas shall be removed and replaced.

1. Conform to Article 1.7 of ACI 301, "Specification for Structural Concrete for Buildings" and to instructions of Engineer.

15.1 COLD WEATHER CONCRETING

A. General: Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.1 and as herein specified.

1. Do not use calcium chloride, salt, materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

B. Mixing, Delivery and Placement: When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), the water and aggregate shall be heated uniformly before mixing, to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. All snow, ice and frost must be removed from the surfaces and materials that will be in contact with the fresh concrete. No concrete shall be placed on frozen subgrade surface material.

C. Curing and Protection: Protection of concrete in cold weather shall continue long enough to ensure the strength required, but not less than 72 hours. The temperatures shall be kept sufficiently above freezing. Protection from freezing for the first 24 hours does not ensure the strength required.

1. The surface temperature of the concrete shall be monitored specially at corners and edges of concrete. Use thermometers or any other equipment approved for this type of work. The Contractor shall provide all the equipment necessary to protect and monitor the curing of concrete. After the concrete has cured and the above requirements are no longer necessary, the temperature shall be decreased slowly and gradually as required by ACI 306.1. Under no

circumstances are sudden changes of temperature in the concrete allowed. Heating units shall be vented. The concrete shall be protected from drying when heated locally by the heating locally by the heating equipment.

2. The heating enclosures, if used, must be strong, windproof and weatherproof.

3. Concrete shall not be exposed to carbon dioxide (CO_2) gas or any other pollution resulting from the use of heating equipment. The temperature shall not exceed those shown in ACI 306.1.

4. The use of urethane foams as insulation shall be avoided if possible or done with caution, as it generates highly noxious fumes when subject to fire.

16.1 HOT WEATHER CONCRETING

A. General: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305R and as herein specified.

B. Mixing, Delivery and Placement: Cool ingredients before mixing to maintain concrete temperature at time of placement below 95 deg F (35 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

1. Reduce concrete mixing time as required to avoid quick stiffening of the concrete.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

17.1 CONCRETE PLACED ON METAL DECK

A. General: Contractor shall provide, at no additional cost to the Owner, the additional volume of concrete necessary due to deflection of structural steel members and metal decking and any other construction effect.

1. Concrete for slabs on metal deck supported by steel members shall be placed and finished in a manner that produces uniformly thick slabs above the steel framing members.

2. Any deck units damaged prior to or during concrete placement shall be removed and replaced prior to placing of concrete in that area.

B. Shoring: Contractor may shore deck and/or steel framing to reduce amount of concrete required, control ponding, and maintain tolerances. Proper design of such shores is the sole responsibility of the Contractor.

18.1 CONCRETE SLABS-ON-GROUND

A. Subgrade Preparation: All slabs-on-ground, unless otherwise noted, shall be placed

on either compacted soil or undisturbed soil of proper bearing capacity.

1. Crushed stone, gravel or porous fill, as shown on the Drawings, shall be placed in layers not more than 8 inches thick and compacted in several passes to achieve specified density of the material.

2. Conduit, drains, piping and other items shall be placed prior to installation of the vapor barrier.

B. Vapor Barrier Installation: Place over stone, gravel or fill. Place sheets with longest dimension parallel to direction of pour. Overlap joints 6 inches and seal with appropriate tape.

1. Tears or holes in barrier shall be properly repaired prior to concreting.

C. Reinforcement: Support reinforcement securely on precast concrete blocks or use other method described in shop drawings and accepted by Engineer.

1. Avoid cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

2. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two inches and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

19.1 LIQUID DENSIFIER/SEALER

A. All interior slabs subject to hard-wheeled vehicular traffic, and so noted on the drawings, shall be treated with the specified liquid densifier/sealer.

B. Spray, squeegee or roll on liquid densifier to clean, dry concrete surface. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product thickens, but not more than 60 minutes after initial application, the surface shall then be squeegeed or vacuumed to remove all excess liquid.

END OF SECTION 033000

SECTION 033000 APPENDIX – CONCRETE MIX DESIGN SUBMITTAL FORM

Project:_____

City:_____

General Contractor:_____

Concrete Contractor:_____

Contact Name:_____

Address:_____

Phone Number:_____

Main Plant Location:_____

Miles from Project Site:_____

Date:_____

Design Characteristics

Use (describe): _____

Strength:_____psi at _____days

Density:_____pcf

Air:_____% Water/cementitious ratio:_____

Design Mix Information – check one

☐ Based on Standard Deviation Analysis of Trial Mixes or Field Experience.

No. of test cylinders:_____ Avg. Strength:___psi

Standard deviation:_____ f'cr: _____psi

f'cr = f'c + 1.34s or f'cr = f'c' + 2.33s - 500

Refer to ACI 318 Sec. 5.3.1 for standard deviation factor if less

than 30 tests

☐ Based on Trial Mix Test Data.

f'cr:_____psi

f'cr = f'c + 1200 psi, for up to 5000 psi

f'cr = 1.10 f'c + 700 psi, for greater than 5000 psi

Materials

	Type/Source	Specific Gravity	Weight Lbs.	Absolute Vol. Cu. Ft.
Cement				
Flyash				
Microsilica				
Fine Aggregate				
Coarse Aggregate				
Water				
Air				
Other				
Total				**27.0 cu. ft.**

Admixtures

	Manufacturer	Dosage Oz/Cwt
Water Reducer		
Air Entraining Agent		
High Range Water Reducer		
Non-Corrosive Accelerator		
Other		

Slump before HRWR _____ inches

Slump after HRWR _____ inches

LABATORY TEST DATA

Compressive Strength

AGE (DAYS)	MIX #1	MIX #2	MIX #3
Water/Cement Ratio			
7	psi	psi	psi
7	psi	psi	psi
28	psi	psi	psi
28	psi	psi	psi

28 average	psi	psi	psi

Required Attachment Checklist

- ☐ Combined aggregate gradation report
  Note: 8%-18% aggregate required to be retained on each side sieve except the top size and #100.
- ☐ Standard deviation analysis summary or trial mixture test data
- ☐ Admixture compatibility certification letters

END OF SECTION 033000 APPENDIX

SECTION 033050 - CAST-IN-PLACE CONCRETE FOR SITE WORK

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
2. Division 2 Section "Concrete Walks and Curbs" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete for site work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, as indicated.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II.

1. Fly Ash: ASTM C 618, Class C or F.
2. Fly Ash: ASTM C 618, Class F.
3. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Severe weathering region, but not less than 3S.
2. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).

C. Water: Potable and complying with ASTM C 94.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

2.6 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.7 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.8 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Maximum Slump: 5 inches (125 mm).

2.9 FABRICATING REINFORCEMENT

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

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

PART 3 - **EXECUTION**

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class C, 1/2 inch (13 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

   1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Chamfer or round exterior corners and edges as indicated.

H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
   1. At least 70 percent of 28-day design compressive strength.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

C. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.

D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of

weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

E. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

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

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and

patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

B. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

3.7 MISCELLANEOUS CONCRETE ITEMS

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

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

3.9 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect / Engineer. Remove and replace concrete that cannot be repaired and patched to Architect's / Engineer’s approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than

1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect / Engineer.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

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

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

END OF SECTION 03300

SECTION 051200 - STRUCTURAL STEEL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section as shown or specified shall be in accordance with the requirements of the Contract Documents.

1.2 WORK INCLUDED

A. Work of this section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver, and install all work of this Section, as shown on the drawings, as specified herein, and/or as required by job conditions, including but not limited to the following:

1. The furnishing and erection of all structural steel shown on the Structural Drawings, including all connections, plates, bearing plates, hangers, and masonry anchor bolts.
2. Making provision for connections of other trades, including cutting, punching, and reinforcing where required, as shown on the Drawings, or for which information is furnished prior to fabrication.
3. The steel erector shall furnish the Concrete Contractor all the necessary anchor bolts for beam base plates, together with all the instructions and templates required for the proper setting thereof.
4. Grouting of all bearing plates furnished under this Section.
5. Shop Drawings of all work under this Section.
6. Shop paint and field touch-up on all work under this Section.
7. All other work and materials as may be reasonably inferred and needed to make the work of this Section complete.

B. WORK NOT INCLUDED

1. Inspection of Structural Steel - By Owner

1.3 CODE REQUIREMENTS

A. All structural steel work shall conform to the following standards except as they are specifically contrary to stipulated requirements of the Drawings and/or these Specifications:

1. American Institute of Steel Construction "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", Latest Edition.

2. AISC "Code of Standard Practice for Steel Buildings & Bridges", Latest Edition.

3. All welding shall conform to the requirements of the American Welding Society "Structural Welding Code", AWS D1.1-88.

1.4 RELATED WORK

A. SHOP DRAWINGS

1. Shop and Erection Drawings shall be prepared immediately after award of Contract.

2. Shop Drawings shall be submitted for approval and shall include all framing plans, base plate location plan and details, and complete painting details, etc.

3. No substitutions of shapes or sizes will be permitted without approval of the Architect.

1.5 QUALITY ASSURANCE

A. Examine all work prepared to receive work of this Section and report any defects affecting installation to General Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

B. The Contractor shall take all field measurements required to verify or supplement indicated dimensions to ensure fitting of new steel to existing work and property lines.

C. The Contractor shall check all existing conditions and framing for conformity with the drawings, and if at variance with the drawings, shall notify the Architect.

PART 2 PRODUCTS

2.1 MATERIALS

A. The Contractor shall obtain from the manufacturers certified mill tests reports which shall be submitted to the Architect as evidence that all materials delivered to the project conform to the following Specifications, latest edition:

1. Structural Steel: ASTM A572, Fy = 50 ksi. Plates, etc. can be ASTM A36, Fy=36 ksi.

2. Welding Electrodes - American Welding Society A5.1, E70 Series.

3. High Strength Bolts - A325F or X, 3/4" diameter, min.

B. INTERIOR PAINT

1. Primer: Tnemec Series 27WB Typoxy

C. EXTERIOR PAINT

1. Primer: Tnemec Series 94-H2O Hydro-Zinc
2. Intermediate Coat: Tnemec Series 27WB Typoxy
3. Finish Coat: Tnemec Series 1095 Endura-Shield

D. GROUT

1. Base Plates: Embeco pre-mixed grout No. 153.
2. Leveling Plates: Embeco pre-mixed mortar No. 167.

PART 3 EXECUTION

3.1 INSTALLATION

A. FABRICATION

1. Workmanship shall be equal to the best practice in the trade.
2. Material shall be clean and straight.
3. All holes shall be accurately drilled or punched at right angles to the member. Burning or drifting unfair holes will not be permitted. Holes that must be enlarged shall be reamed. Holes for the attachment or passage of work by others shall be provided as required. All burrs shall be removed. Manual flame cutting shall be done only with a mechanically guided torch.
4. Welding for structural steel shall be performed by qualified operators and shall be in accordance with the "Structural Welding Code" of the American Welding Society, latest edition, and with the AISC Specification heretofore mentioned.
5. All welding shall be subject to visual inspection. All fillet welds may be subject to non-destructive testing when the appearance is suspect. Repairs of welds shall be performed in accordance with AWS Section 3.7.

B. ERECTION

1. All work shall be erected plumb, square and true to lines and levels in strict accordance with the structural requirements of the building.
2. All machinery, apparatus and staging required for the erection of steel work in a thoroughly safe and efficient manner shall be provided by the Contractor. he shall install, maintain and remove without injury to the other work such scaffolding, temporary bracing, etc., as may be necessary or required.

C. CONNECTIONS

1. All connections shall be as shown on the structural drawings.

D. PAINTING

1. All structural steel shall receive the following treatment except members which are to be encased in concrete, contact surfaces for bolted joints and finished bearing surfaces.

A. EXTERIOR ABOVE GRADE STEEL HEAVY DUTY EXPOSURE

Surface Preparation:	SSPC-SP6 Commercial Blast
Primer:	Tnemec Series 94-H2O Hydro-Zinc
Intermediate:	Tnemec Series 27WB Typoxy in a color similar to finish.
Finish:	Tnemec Series 1095 Endura-Shield in an approved color

B. INTERIOR EXPOSED OVERHEAD STEEL

Surface Preparation:	SSPC-SP2 hand tool cleaning SSPC-SP3 Power Tool cleaning.
Primer:	Tnemec Series 27WB Typoxy

1. Field Touch-up

   a. After erection, areas damaged, abraded, showing rust, bolt heads, connections and other bare areas shall be thoroughly cleaned to the standard of shop cleaning and then thoroughly brush painted with a coat of Tnemec.

3.2 INSPECTION

A. INSPECTION AND CORRECTIONS

1. The engineer of Record will inspect compliance with the provisions of the Specifications and Drawings during various phases of construction.

2. Should additional visits be required which are necessitated by failure of the Contractor to perform his work in accordance with the Plans and Specifications or if additional design or drafting time is required for corrective measures caused by failure to perform in accordance with Plans and Specifications, the Contractor shall reimburse the Engineer of Record at the rate of 2.50 times direct personnel expense plus out of pocket traveling expenses incurred.

B. INSPECTION AND TESTING

1. The owner shall retain a Professional Engineer approved by the Engineer of Record to perform the following inspection services:

   a. Shop Inspection
      i). Visual examination of all fillet welding.
      ii). Examination of all fabricated pieces for proper cleaning prior to shop painting.
      iii). Examination of all shop painting.
      iv. Examination of loading of steel to prevent damage during shipping.

   b. Field Inspection
      i). Examination of all pieces of steel for straightness and alignment.
      ii). Examination of all field welding.

iii). Examination of touch-up painting.

2. The Engineer shall indicate to the Contractor where remedial work must be performed.

3. The Engineer shall prepare daily reports and submit them in triplicate at weekly intervals to the Architect.

4. When all work has been approved by the Engineer, the Engineer shall certify that the installation is in accordance with the design and specification requirements (including applicable codes).

5. Any material not in accordance with these Specifications shall, at the request of the Architect, be removed from the site by the Contractor and be replaced as specified.

3.03 WARRANTY

A. Guarantee all work of this section for one (1) year in accordance with General Conditions and Special Conditions.

B. Work of this section as shown or specified shall be in accordance with the requirements of the Contract Documents.

END OF SECTION

SECTION 054000 - COLD FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior load-bearing wall framing.

B. Interior load-bearing wall framing.

C. Exterior non-load-bearing wall framing.

D. Floor joist framing.

E. Ceiling joist framing.

F. Fasteners and connectors for framing.

1.2 RELATED SECTIONS

A. Section 05500 - Metal Fabrications.

B. Section 06100 - Rough Carpentry.

C. Section 07210 - Building Insulation.

D. Section 07260 - Vapor Retarders.

E. Section 07910 - Joint Sealers.

F. Section 09260 - Gypsum Board Assemblies.

G. Section 09255 - Exterior Sheathing Board.

1.3 REFERENCES

A. AISI - Specification for the Design of Cold-Formed Steel Structural Members, Code of Standard Practice (COSP).

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM A 90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

D. ASTM A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

E. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

G. ASTM A 924 - Standard Specification for General Requirements for Steel

Sheet, Metallic-Coated by the Hot-Dip Process.

H. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

I. ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

J. ASTM A 1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

K. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

L. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

M. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

N. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

O. AWS D.1.3 - Structural Welding Code - Sheet Steel.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Refer to Structural Drawings and General Notes.

B. Performance Requirements:
   1. Design system components per AISI reference. Provide for movement of components due to thermal variations without damage, failure, or excessive stress on components.
   2. Compute structural properties per AISI - Specifications for the Design of Cold-Formed Steel Structural Members.
   3. Design exterior wall system for environmental loads as outlined in the ASCE 7 latest edition to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   4. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   5. Maximum Allowable Deflection:
      a. Gypsum Board: L/360 of span under total design loads.
      b. Exterior Insulation Finish System: L/360 of span under total design loads.
      c. Plaster or Stucco: L/360 of span under total design loads.
      d. Brick Veneer: L/600 of span under total design loads.
   6. Horizontal Assemblies:
      a. Maximum Allowable Deflection: L/360 of span under total design loads.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Structural Calculations:
   1. Submit structural calculations prepared by manufacturer's engineer for approval. Submittal shall be sealed by a professional engineer registered in the state of the Project.
   2. Description of design criteria.
   3. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
   4. Selection of framing components, accessories and welded connection requirements.
   5. Verification of attachments to structure and adjacent framing components.
   6. Engineer shall have a minimum of 5 years experience with projects of similar scope.
   7. Calculations, signed and sealed by NY, P.E. Calculations shall be long form, showing the reference equations, input actual numbers and results and clear reference of plans where the calculations came from. The calculations are made for the review of EOR and for his comments. Short or abbreviated form calculations will not be accepted. Substitutions of details or systems, if proposed, will be accepted only at the discretion of EOR and Architect. It is the contractor's responsibility to prove "Equal", through his calculations.
   8. JAMBS of all openings shall be framed with built-up studs, using minimum 50% of interrupted studs on each side of openings. For all field construction, tolerances in excess of ¾" shall be assumed. For bearing walls, studs shall be assumed to be misaligned.

D. Shop Drawings:
   1. Submit shop drawings prepared by the manufacturer showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.
   2. Show connection details with screw types and locations, weld lengths and locations, and other fastener requirements.
   3. Where prefabricated or prefinished panels are to be provided, provided drawings depicting panel configurations, dimensions and locations.
   4. Plans sections and details shall be fully diminished, showing all openings, floor elevations, etc.

E. Welder's Certificates: Submit manufacturer's certificates, certifying welders employed on Work, verifying AWS qualifications within the previous 12 months.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum 5 years documented experience.

B. Installer Qualifications: Installer experienced in performing work of this Section who has specialized in installation of work similar to that required for the Project.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Construct areas designated by Architect.
   2. Do not proceed with remaining work until material, details and workmanship are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store materials protected from exposure to rain, snow or other harmful weather conditions, at temperature and humidity conditions per AISI COSP section F3.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturer: Marino\WARE or approved equal.

2.2 MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: ST33H (ST230H)
   2. Grade: ST50H (ST340H)

3. Grade: As required by structural performance.
4. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).
5. Coating: G90 (Z275) or equivalent.

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

B. Steel Track: Manufacturer's U-shaped steel track, of web depths indicated, unpunched, with straight flanges.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

B. Steel Track: Manufacturer's U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web. Refer to Structural Drawings for anticipated deflection of primary structural elements.

D. Single Deflection Track (Deflex Track, Slotted Slip Track): Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.

E. Double Deflection Tracks (Deflex Track, Slotted Slip Track): Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Inner Track: Of web depth indicated or needed.

F. Slotted Slip Track: Manufactured by CEMCO. U-shaped track with 1-1/2 inch vertical slots spaced 1 inch along the legs to allow vertical deflection.

G. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 FLOOR JOIST FRAMING

A. Steel Joists: Cold-formed steel joists, of web depths indicated, with punched enlarged service holes with stiffened flanges.

B. Steel Joist Track: Cold-formed steel joist track, of web depths indicated, unpunched, with unstiffened flanges.

2.6 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Cold-formed steel joists, of web depths indicated, punched with enlarged service holes, stiffened flanges.

2.7 FRAMING CONNECTORS

A. Framing Connectors: Marino\WARE FrameRite Connectors, steel-framing accessories fabricated from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Web Stiffeners (JS).
   2. Solid Blocking (JB).
   3. Utility Angles (UA).
   4. Joist Hangers/Bridle Hangers (HJCT/BH).
   5. Gusset Plates (GP).
   6. Rigid Clips (RCC).
   7. Katz Blocking (KB).
   8. BridgeRite Clips (BR).
   9. Breakaway Clips (BA).
   10. U-Flex Track.
   11. SIMPSON Strong-Tie Connectors (Steel-to-Steel).

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E488. Refer to Structural Drawings.

C. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190. Refer to Structural Drawings.

D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws. Refer to Structural Drawings.
   1. Marino\WARE FrameRITE fasteners.

E. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Cement Grout: Portland cement, ASTM C150, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration. Refer to Structural Drawings.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and 30-minute working time. Refer to Structural Drawings.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.10 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welds, screw fasteners, clinch fasteners, or rivets as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect supporting work of all other trades.
   1. Verify bearing surfaces and substrates are acceptable for construction work of this Section.
   2. Verify that concealed wood blocking has been installed in the proper locations.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 FASTENING

A. Field Welding: Per AWS D1.3, and the following:
   1. Stud-to-track connections: 1/2 inch (13 mm) fillet weld, full length of inside flange dimension, inside each flange of stud onto track web.
   2. Other connections: Flat, plug, butt, or seam.
   3. Minimum Steel Thickness for Welded Connections: 18 gauge.

B. Field Fastening: Minimum 2 self-tapping metal screws per connection, unless otherwise indicated.

3.3 ERECTION

A. General Erection Requirements:
   1. Install cold-formed framing in accordance with requirements of ASTM C1007.
   2. Install in compliance with applicable sections of the AISI Standard for Cold-Formed Steel Framing General Provisions.
   3. Provide for erection stresses. Provide temporary bracing as construction activities progress.
   4. Erect load-bearing components in full-length single piece. Splicing of load bearing components is prohibited.
   5. Brace and reinforce load-bearing assemblies as indicated or required for full design strength.

B. Wall Systems:
   1. Handle and lift prefabricated panels in a manner so as not to cause distortion in any member.
   2. Anchor runner track securely to the supporting structure as shown on the erection drawings. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between all concrete and steel connections.
   3. Butt all track joints. Securely anchor abutting pieces of track to a common structural element, or butt-weld or splice together.
   4. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks except when vertical movement is specified.
   5. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.
   6. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.
   7. Frame wall openings to include headers and supporting studs as shown in the drawings.
   8. Place studs at maximum 16 inches on center; not more than 2 inches from abutting walls, and at each side of openings. Connect studs to tracks using mechanical fastener method.
   9. Construct corners using minimum 3 studs. Double studs at wall openings, doors, and window jambs, 1 of which is full length unless indicated otherwise.
   10. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
   11. Attach cross studs or furring channels to studs for attachment of fixtures anchored to walls.
   12. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
   13. Touch-up field welds and damaged galvanized and primed surfaces with primer.
   14. Provide bridging (horizontal stiffeners) at 4 feet 0 inches on center maximum vertical spacing for exterior and load bearing metal stud walls.

C. Steel Joists:
   1. Locate joist end bearing directly over load bearing studs or provide load-distributing member to top of stud track.
   2. Provide web stiffeners at reaction points where indicated in drawings.
   3. Provide joist bridging as shown in drawings.
   4. Provide end blocking where joist ends are not otherwise restrained from

rotation.

5. Place joists at maximum 12 inches on center and not more than 2 inches from abutting walls. Connect joists to supports using mechanical fastener method.
6. Touch-up field welds and damaged galvanized surfaces with primer.

3.4 FIELD QUALITY CONTROL

A. Field testing and inspection will be performed by independent testing agency as specified herein, and per Section 01460.

B. Refer to Structural Drawings and General Structural Notes for inspection requirements.

C. If tests indicate Work does not meet specified requirements, remove Work, replace with new material, and retest at no cost to Owner.

D. Visually inspect 100 percent of welds for specified length, size, and continuity per AWS D1.3 for metal less than 1/8 inch thickness. For Work designed as a structural element. Provide testing and inspection for field welds previously specified per Section 05120.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Miscellaneous steel framing and supports.
2. Stair Railings
3. Shelf angles.
4. Steel weld plates and angles.
5. Miscellaneous steel trim.
6. Metal ladders.
7. Pipe guards.
8. Metal floor plate and supports.
9. Abrasive metal nosings, treads, and thresholds.

B. See Division 5 Section "Metal Stairs" for metal-framed stairs.

C. See Division 5 Section "Pipe and Tube Railings" for metal pipe and tube railings.

D. See Division 5 Section "Gratings" for metal gratings.

E. See Division 5 Section "Ornamental Metal" for ornamental metal items.

F. See Division 5 Section "Ornamental Railings" for ornamental metal railings.

G. See Division 5 Section “Expansion Joints”

1.2 SUBMITTALS

A. Product Data: For the following:
1. Metal nosings and treads.
2. Stair railings, posts and layout.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

C. Shop Drawings: Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

D. Templates: For anchors and bolts.

E. Samples: For each type and finish of extruded element, T, L. Each type of stair nosing and tread.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS

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

B. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Stainless-Steel Bars and Shapes: ASTM A 276, Type [304] [316L].
3. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
4. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
5. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface

    a. Products:

        1) IKG Industries, a Harsco company; Mebac.
        2) W. S. Molnar Company; SlipNOT.

6. Steel Tubing: ASTM A 500, cold-formed steel tubing.
7. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
8. Slotted Channel Framing: Cold-formed metal channels complying with MFMA-3, 1-5/8 by 1-5/8 inches (41 by 41 mm). Channels made from galvanized steel complying with ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.

9. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

C. Nonferrous Metals:

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6.
2. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.
3. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

D. Treads: Steel pan filled with concrete.

2.3 FASTENERS

A. General: Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Cast-in-Place Anchors in Concrete: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.

B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Products:

a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

E. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a

minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.5 FABRICATION

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

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
5. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches (600 mm) o.c.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate steel girders for wood frame construction from continuous steel shapes. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches (600 mm) o.c.
2. Fabricate steel pipe columns for supporting wood frame construction with steel baseplates and top plates welded to pipe with fillet welds the same size as pipe wall thickness.

C. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

1. Lintels in Exterior Walls: Galvanize.

D. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.

E. Structural-Steel Door Frames: Fabricate from structural shapes and bars fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel channel stops secured with countersunk machine screws. Reinforce frames and drill and tap as necessary to accept finish hardware. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

1. Exterior Frames: Galvanize.

F. Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Exterior Miscellaneous Steel Trim: Galvanize.

G. Metal Ladders and Safety Cages: Comply with ANSI A14.3, unless otherwise indicated.

1. Space siderails [16 inches (406 mm)] [18 inches (457 mm)] apart, unless otherwise indicated.
2. Steel Ladder Construction: Flat bar siderails, with 3/4-inch- (19-mm-) diameter steel bar rungs fitted in centerline of siderails, plug-welded, and ground smooth on outer rail faces.[Provide nonslip surfaces on top of each rung.]
3. Aluminum Ladder Construction: Extruded channel or tube siderails, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick; with extruded tube rungs, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, fitted into centerline of siderails and fastened by welding or with stainless-steel fasteners or brackets and aluminum rivets. Provide rungs with ribbed tread surfaces.
4. Exterior Steel Ladders and Safety Cages: Galvanize

H. Pipe Guards: Fabricate from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.

I. Metal Floor Plate:

1. Fabricate from rolled-steel floor plate of thickness indicated below:

   a. Thickness: 1/8 inch (3.2 mm).

2. Provide steel angle supports as indicated.
3. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

J. Abrasive Metal Nosings, Treads and Thresholds.

1. Cast-Metal Units: Cast gray iron, Class 20 with an integral abrasive finish.

   a. Manufacturers:

      1) American Safety Tread Co., Inc.
      2) Balco Inc.
      3) Barry Pattern & Foundry Co., Inc.
      4) Granite State Casting Co.
      5) Safe-T-Metal Co.
      6) Wooster Products Inc.

2. Extruded Units: Aluminum, with abrasive filler in an epoxy-resin binder.

    a. Manufacturers:

        1) ACL Industries, Inc.
        2) American Safety Tread Co., Inc.
        3) Amstep Products.
        4) Armstrong Products, Inc.
        5) Balco Inc.
        6) Granite State Casting Co.
        7) Wooster Products Inc.

    b. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
    c. Provide solid-abrasive-type units without ribs.

3. Provide anchors for embedding units in concrete, either integral or applied to units.
4. Drill for mechanical anchors and countersink. Locate not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c.

2.6 FINISHES

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

B. Steel and Iron Finishes:

1. Hot-dip galvanize items as indicated to comply with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed metal fabrications:

    a. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
    b. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

3. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.

C. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
3. Protect surfaces of dissimilar materials with a coating of bituminous coating.

END OF SECTION 055000

SECTION 055110 - METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Industrial-type stairs with steel floor plate treads
2. Steel tube railings attached to metal stairs and to walls adjacent to metal stairs.

B. See Division 05 Section "Pipe and Tube Railings" for pipe and tube railings.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Uniform load of 25 lbf/sq. ft. applied horizontally.
c. Infill load and other loads need not be assumed to act concurrently.

C. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.3 SUBMITTALS

A. Product Data: For metal stairs.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 COORDINATION

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

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS

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

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500 (cold formed).

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25.

F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30.

2.3 MISCELLANEOUS MATERIALS

A. Cast-Metal Abrasive Nosings: Cast gray iron, Class 20, with an integral abrasive finish.

1. Manufacturers:

a. American Safety Tread Co., Inc.

2. Apply bituminous paint to concealed bottoms, sides, and edges of units set into concrete.

B. Extruded Abrasive Nosings: Extruded-aluminum units with abrasive filler.

1. Manufacturers:

a. American Safety Tread Co, Inc.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Provide solid-abrasive-type units without ribs.
4. Apply clear lacquer to concealed bottoms, sides, and edges of units set into concrete.

C. Fasteners: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls.

D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

2.4 FABRICATION

A. Manufacturers

1. Sharon Companies Ltd. (The)

B. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux

immediately. At exposed connections, finish exposed welds smooth and blended.
2. Use connections that maintain structural value of joined pieces.
3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
4. Form bent-metal corners to smallest radius possible without impairing work.
5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

C. Stair Framing: Fabricate stringers of steel plates and channels. Construct platforms of steel channel headers and miscellaneous framing members.

1. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
2. Where stairs are enclosed by gypsum-board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below.
3. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms from steel sheet of thickness needed to comply with performance requirements but not less than 0.0966 inch. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

E. Metal Floor Plate Stairs: Form treads and platforms from rolled-steel floor plate of thickness needed to comply with performance requirements but not less than 1/4 inch. Form treads with integral nosing and back edge stiffener. Weld steel supporting brackets to stringers and weld treads to brackets.

F. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Configuration: 1-1/2-inch- square top and bottom rails, 1-1/2-inch- square posts, and 1/2-inch- square pickets spaced less than 4 inches clear.
2. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Form changes in direction of railings by bending or by inserting prefabricated fittings.
4. Form curves by bending members in jigs to produce uniform curvature without buckling.
5. Close exposed ends of railing members with prefabricated end fittings.
6. Provide wall returns at ends of wall-mounted handrails.
7. Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
8. Connect posts to stair framing by direct welding.

2.5 FINISHES

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

B. Hot-dip galvanize items indicated to be galvanized. Comply with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed products:

1. Exterior Stairs (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

B. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

D. Attach handrails to wall with wall brackets.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

E. Adjusting and Cleaning:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055110

SECTION 055120 - FIXED METAL LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ladders.

B. Ships Ladders.

1.2 RELATED SECTIONS

A. Section 05500 – Metal Fabrications: Fasteners and installation requirements used to attach ladders to structure.

B. Section 15050 – Basic Electrical Materials and Methods: For electrical grounding of ladders.

1.3 REFERENCES

A. ASTM A 36/A 36M Steel Plates, Shapes & Bars.

B. OSHA 1910.27 – Fixed Ladders.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product.

C. Shop Drawings:

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.

2. Provide templates for anchors and bolts specified for installation under other Sections.

3. Provide reaction loads for each hanger and bracket.

D. Qualification Data:

1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.

F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing fixed steel ladders similar to those indicated for this Project.

1. Record of successful in-service performance.
2. Sufficient production capacity to produce required units.
3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.8 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.9 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.1 METALS

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

B. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M

2. Stainless-Steel Bars and Shapes: ASTM A 276, Type [304] [316L].

3. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

4. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

5. Abrasive-Surface Floor Plate: Steel plate [with abrasive granules rolled into surface] [or] [with abrasive material metallically bonded to steel by a proprietary process].

a) Manufacturer:

1) Karnel, Clarks Summit, PA Toll Free Tel: 1.800.517.1396.

6. Steel Tubing: ASTM A 500, cold-formed steel tubing.

7. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

8. Slotted Channel Framing: Cold-formed metal channels complying with MFMA-3, 1-5/8 by 1-5/8 inches (41 by 41 mm). Channels made from galvanized steel complying with ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.

9. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.2 FASTENERS

A. General: Type [304] stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Cast-in-Place Anchors in Concrete: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.3 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.

B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Products:

a.) Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.

C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

E. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.4 FABRICATION

A. General: Preassemble items in the shop to greatest extent possible per construction documents. Use connections that maintain structural value of joined pieces.

1) Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

2) Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.

3) Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

4) Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

5) Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches (600 mm) o.c.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1) Fabricate steel girders for wood frame construction from continuous steel shapes. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches (600 mm) o.c.

2) Fabricate steel pipe columns for supporting wood frame construction with steel baseplates and top plates welded to pipe with fillet welds the same size as pipe wall thickness.

C. Metal Ladders: Comply with ANSI A14.3, unless otherwise indicated.

1) Space siderails 18 inches (457 mm) part, unless otherwise indicated.

2) Steel Ladder Construction: Flat bar siderails, with 3/4-inch- (19-mm-) diameter steel bar rungs fitted in centerline of siderails, plug-welded, and ground smooth on outer rail faces.[Provide nonslip surfaces on top of each rung.]

3) Exterior Steel Ladders: [Galvanize] [Prime with zinc-rich primer].

2.6 FINISHES

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

B. Steel and Iron Finishes:

1) Hot-dip galvanize items as indicated to comply with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.

2) Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed metal fabrications:

   a. Exteriors (SSPC Zone 1B)[and Items Indicated to Receive Zinc-Rich Primer]: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

   b. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

3) Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting," for shop painting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

1) Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
2) Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
3) Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 05512

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SECTION 055210 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Painted Steel tube railings.

B. See Division 05 Section "Metal Stairs" for steel tube railings associated with metal stairs.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1.3 Handrails:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Uniform load of 25 lbf/sq. ft. applied horizontally.
c. Infill load and other loads need not be assumed to act concurrently.

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

1.4 SUBMITTALS

A. Product Data: For mechanically connected railings, grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples: For each exposed finish required.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Pipe and Tube Railings:

a. Sharpe Products.
b. Wagner, R & B, Inc.; a division of the Wagner Companies.
c. CR Lawrence

2.2 METALS

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

B. Steel and Iron:

1. Tubing: ASTM A 500 (cold formed)
2. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
3. Plates, Shapes, and Bars: ASTM A 36/A 36M.
4. Castings: Either gray or malleable iron, unless otherwise indicated.

a. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
b. Malleable Iron: ASTM A 47/A 47M.

5. Perforated infill panel: 11 ga ¼” round on 3/8 staggered centers.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Provide concealed fasteners, unless unavoidable or standard for railings indicated.
1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Anchors: Provide cast-in-place, chemical anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

D. Shop Primers: Provide primers that comply with Division 09 painting Sections. Section "High-Performance Coatings."

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

F. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

G. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer compatible with finish paint systems indicated, and complying with SSPC-Paint 5.

H. Grout and Anchoring Cement: Factory-packaged, nonshrink, nonmetallic grout complying with ASTM C 1107; or water-resistant, nonshrink anchoring cement; recommended by manufacturer for exterior use.

2.4 FABRICATION

A. General: Fabricate railings to comply with design, dimensions, and details indicated, but not less than that required to support structural loads.

B. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

C. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings.

D. Form changes in direction by bending.

E. Form curves by bending in jigs to produce uniform curvature; maintain cross section of member throughout bend without cracking or otherwise deforming exposed surfaces.

F. Close exposed ends of railing members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

2.5 FINISHES

A. Steel and Iron:
   1. Shop-Primed Galvanized Railings: After galvanizing, clean railings, treat with metallic-phosphate process, and apply primer to comply with SSPC-PA 1.
   2. Shop-Primed Steel Finish: Prepare to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" and apply primer to comply with SSPC-PA 1.

2.6 PAINTING

A. Steel and Iron:
   1. Shop-Primed Galvanized Railings: After galvanizing, clean railings, treat with metallic-phosphate process, and apply primer to comply with SSPC-PA 1.
   2. Shop-Primed Steel Finish: Prepare to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" and apply primer to comply with SSPC-PA 1.
   3. Color to be approved by architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation.

   1. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Anchor posts in concrete by inserting into formed or core-drilled holes and grouting annular space.

C. Anchor posts to metal surfaces with oval flanges.

D. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

E. Attach handrails to wall with wall brackets where required.

   1. Use type of bracket with predrilled hole for exposed bolt anchorage.
   2. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs.
   3. For steel-framed partitions, fasten to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
   4. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

F. Adjusting and Cleaning:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055210

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SECTION 057500 - DECORATIVE FORMED METAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Closures and trim.
2. Filler panels.

B. See Division 05 Section "Decorative Metal" for items made primarily from plate, bars, extrusions, tubes, castings, and other forms of metal, but which may include sheet metal components.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including finishes.

B. Shop Drawings: Include plans, elevations, sections, and details of components and their connections. Show anchorage and accessory items. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.

C. Samples: For each type of exposed finish required, prepared on 6-inch- square samples of metal of same thickness and material indicated for the Work.

PART 2 - PRODUCTS

2.1 SHEET METAL

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher, with not less than strength and durability of alloy 5005-H32.

2.2 MISCELLANEOUS MATERIALS

A. Gaskets: As required to seal joints in ornamental formed metal, and as recommended in writing by ornamental formed-metal manufacturer.

B. Sealants, Exterior: ASTM C 920; silicone sealant; of grade, class, and use classifications required to seal joints in ornamental formed metal and remain

weathertight; and as recommended in writing by ornamental formed-metal manufacturer.

C. Sealants, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; and as recommended in writing by ornamental formed-metal manufacturer.

1. Use sealant that has a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

D. Filler Metal and Electrodes: Type and alloy as necessary for strength, corrosion resistance, and compatibility in fabricated items and that will match the color of metal being joined.

E. Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Provide Phillips flat-head machine screws for exposed fasteners.

F. Anchors: Provide anchors of type, size, and material recommended by manufacturer. Use nonferrous-metal or hot-dip galvanized anchors for exterior installations.

G. Sound-Deadening Materials:

1. Insulation: Unfaced, mineral-fiber blanket insulation complying with ASTM C 665, Type I, and passing ASTM E 136 test.
2. Mastic: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Isolation Coating: Manufacturer's standard coating.

2.3 PAINTS AND COATINGS

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.

2.4 FABRICATION

A. Shop Assembly: Preassemble ornamental formed-metal items in shop to greatest extent possible to minimize field splicing and assembly.

B. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- wide hem on the concealed side, or ease edges and support them with concealed stiffeners.

C. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness and sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

D. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

E. Closures and Trim: Form from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, with weather tight joints at exterior installations.

1. Aluminum Sheet: 0.090 inch

F. Filler Panels: Form from two sheets of metal of type and thickness indicated below, separated by channels formed from the same material, producing a panel of same thickness as mullions, unless otherwise indicated. Incorporate reveals, trim, and concealed anchorages.

1. Fill interior of panel with sound-deadening insulation permanently attached to inside panel faces.
2. Adhesively attach gaskets to filler panel edges where they abut mullions or glazing.

2.5 FINISHES

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

B. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for steel sheet finishes.

C. Aluminum Finishes: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Class I, Clear Anodic Finish: AA-M12C22A41 complying with AAMA 611.
2. Class I, Color Anodic Finish: AA-M12C22A42/A44 complying with AAMA 611.

a. Color: As selected from full range of industry colors and color densities.

3. Baked-Enamel Finish: AA-C12C42R1x, with thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils.
4. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
5. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place ornamental formed-metal items level and plumb and in alignment with adjacent construction.

B. Use concealed anchorages where possible.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 057500

SECTION 061100 - ROUGH CARPENTRY

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Exposed Framing: Dimension lumber not concealed by other construction.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. RIS - Redwood Inspection Service.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB - West Coast Lumber Inspection Bureau.
6. WWPA - Western Wood Products Association.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and the following:

a. Chromated copper arsenate (CCA).

2.3 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Joists and Other Framing: Construction or No. 2 grade of the following species:
1. Southern pine; SPIB.

2.4 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
1. Nailers.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

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

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

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.6 METAL FRAMING ANCHORS

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
   1. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.

   1. Thickness: 0.050 inch (1.3 mm)

C. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.

D. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

   1. Width: 3/4 inch (19 mm)
   2. Thickness: 0.050 inch (1.3 mm).
   3. Length: 16 inches (400 mm)

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

3.2 WOOD NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

3.3 WOOD FRAMING INSTALLATION, GENERAL

A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Do not splice structural members between supports.

C. Where built-up beams or girders of 2-inch nominal- (38-mm actual-) dimension lumber on edge are required, fasten together with 2 rows of 20d (100-mm) nails spaced not less than 32 inches (812 mm) o.c. Locate one row near top edge and other near bottom edge.

3.4 FLOOR JOIST FRAMING INSTALLATION

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists as follows:
1. Where framed into wood supporting members, by using metal joist hangers.

B. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches (102 mm) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist over supports.

C. Anchor members paralleling masonry with 1/4-by-1-1/4-inch (6.4-by-32-mm) metal strap anchors spaced not more than 96 inches (2438 mm) o.c., extending over and fastening to 3 joists. Embed anchors at least 4 inches (102 mm) into grouted masonry with ends bent at right angles and extending 4 inches (102 mm) beyond bend.

D. Provide bridging of type indicated below, at intervals of 96 inches (2438 mm) o.c., between joists.
1. Steel bridging installed to comply with bridging manufacturer's written instructions.

END OF SECTION 061100

SECTION 061350 - WOOD FENCE

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Cast in Place Concrete: Section 03300

1.02 REFERENCES

A. Standards: Comply with the following unless otherwise specified or indicated on the Drawings:
   1. Lumber: American Softwood Lumber Standard PS 20; U.S. Department of Commerce.

B. Preservative Treatment: American Wood Preserver's Bureau (AWPB), by the American Wood Preservers Institute (AWPI).

1.03 SUBMITTALS

A. Shop Drawings: Show application to project. Machine duplicated copies of Contract Drawings will not be accepted.

B. Quality Control Submittals:
   1. Pressure Treatment Certificates: Certification by treating plant stating chemicals and process used, net amount of salts retained, and conformance with applicable standards.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Keep materials dry during delivery. Store materials 6 inches minimum above ground surface. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and provide air circulation between stacks.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber; General: Furnish seasoned dimension lumber dressed to nominal sizes indicated with 19 percent maximum moisture content at time of dressing, marked "S-DRY". Comply with dry size requirements of PS 20.
   1. Dress: Surfaced 4 sides (S4S) unless otherwise indicated.

B. Lumber; 2 inches through 4 inches thick, less than 6 inches wide: Furnish Construction Grade Douglas Fir.

E. Steel Brackets: ASTM A 36 galvanized ASTM A 123.

F. Fasteners: Galvanized, furnish type and size required.
   1. Nails and Staples: FS FF-N-105.
   2. Wood Screws: FS FF-S-111.
   3. Bolts and Studs: FS FF-B-575.
   4. Nuts: FS FF-N-836.
   5. Washers: FS FF-W-92.

2.02 PRESERVATIVE TREATMENT

A. Pressure treat lumber in accordance with applicable American Wood Preserver's Bureau (AWPB) Requirements.

B. Complete fabrication of items to be treated to the greatest extent possible prior to treatment. Where items must be cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.

C. Inspect wood after treating and drying. Discard warped or twisted items.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wood members plumb, level true and straight, and free of distortion. Conform to all details shown on the drawing.

END OF SECTION 061350

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes, but is not limited to the following:
   1. Roof sheathing.
   2. Wall Sheathing
   3. Building paper.
   4. Cementitious backer units installed as part of tile installations.

1.2 SUBMITTALS

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

   1. Include data for wood-preservative treatment and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

B. Research/Evaluation Reports: For the following:

   1. Preservative-treated plywood.
   2. Fire-retardant-treated plywood.
   3. Building wrap.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Type and Thickness: Type X, 5/8 inch thick.

B. Cementitious Fiber-Mat Reinforced Sheathing: ASTM C 1325, ANSI A118.9, cementitious backer.

1. Type and Thickness: 5/8” inch thick.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated.

1. For wall and roof sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.3 WEATHER-RESISTANT SHEATHING PAPER

A. Use of Sheathing Paper shall be coordinated with the Exterior Finish system and its manufacturer recommendations.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, of type recommended by sheathing and tape manufacturers.

2.5 MISCELLANEOUS MATERIALS

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

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

B. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.

C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with ASTM C 1280, 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 1/4-inch gap where they abut masonry or similar materials.

3.3 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed tape in sealant. Apply sealant to exposed fasteners. Seal other penetrations and openings.

3.5 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
2. Lap flashing over weather-resistant building paper at bottom and sides of openings.
3. Lap weather-resistant building paper over flashing at heads of openings.
4. After flashing has been applied, roll surfaces with a hard rubber or metal roller.

END OF SECTION 061600

SECTION 062000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the carpentry work as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Blocking and miscellaneous wood, including plywood subflooring and wall lining for telephone and electric closets.

2. Rough hardware.

3. Installation only of finish hardware.

4. Installation only of doors and hollow metal frames.

1.3 RELATED SECTIONS

A. Architectural woodwork - Section 06400.

B. Thermal and Moisture Protection - Section 7

C. Doors and Windows - Section 8

D. Finish hardware - Section 08710

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Plywood Standard: Comply with PS 1 and American Plywood Assoc. (APA).

C. Shop fabricate carpentry work to the extent feasible and where shop fabrication will result in better workmanship than feasible for on site fabrication.

D. Grade Marks: Identify lumber and plywood by official grade mark.

1. Lumber: Grade stamp to contain symbol of grading agency certified by Board of Review, American Lumber Standards Committee, mill number or name, grade of lumber, species grouping or combination designation, rules under which graded where applicable, and condition of seasoning at time of manufacture.

a. S-Dry: Maximum nineteen (19) percent moisture content as per ASTM D2016.

1.5 SUBMITTALS

A. Pressure Treatment: Include certification by treating plant stating chemicals and process used, net amount of salts retained and conformance with applicable standards.

B. Fire-Retardant Treatment: Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.

1.6 PRODUCT HANDLING

A. Deliver carpentry materials to the site ready to use with each piece of lumber clearly marked as to grade, type and mill, and place in an area protected from the elements.

B. Deliver rough hardware in sealed kegs and/or other containers which shall bear labels as to type and kind.

C. Pile lumber for rough usage, when delivered to the site in stacks to insure drainage and with a minimum clearance of six (6) inches above grade. Cover stacks with tarpaulins or other watertight coverings. Store grounds and similar small sized lumber inside the building as soon as possible after delivery.

D. Do not store seasoned lumber in wet or damp portions of the building.

E. Protect fire retardant treated materials against high humidity and moisture during storage and erection.

F. Remove delivered materials which do not conform to specified grading rules or are otherwise not suitable for installation from the job site and replace with acceptable materials.

G. All items specified in Section 08700 of this specification entitled “Finish Hardware” shall be received, accounted for, stored and applied under this Section.

H. Hardware shall be sorted and stored in space assigned by Contractor and shall be kept at all times under lock and key. The safety and preservation of all items delivered will be the responsibility of the Contractor.

1.7 JOB CONDITIONS

A. Installer must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed, and notify the Contractor in writing of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer and the Architect.

B. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 PRODUCTS

2.1 WOOD MATERIAL

A. General

1. All wood shall be sound, flat, straight, well seasoned, thoroughly dry and free from all defects. Warped or twisted wood shall not be used.

2. For miscellaneous wood blocking, grounds, furring as required, use Utility Grade Coastal Douglas Fir or Southern Pine, free from knots, shakes, rot or other defects, straight, square edges and straight grain, air seasoned with maximum moisture content of nineteen (19) percent. Wood shall be S4S, S-Dry, complying with PS-20.

3. Plywood for rough carpentry work shall conform to PS-74 and APA standards best grade for intended use.

4. Plywood for telephone and electric closets, provide 3/4" thick C-D EXT-APA plywood, fire retardant treated as specified herein.

B. Wood Treatment

1. All interior wood material shall be fire retardant treated to comply with the AWPA standards (C20 for lumber, C27 for plywood) for pressure impregnation with fire retardant chemical to achieve a flame spread rating of not more than 25 (UL Class "FR-S") when tested in accordance with UL Test 723 or ASTM E84.

   a. After treatment, kiln dry to a moisture content of fifteen (15) percent; if wood is to be painted or finished, kiln dry to a moisture content of twelve (12) percent. Treatment shall be equal to "Flameproof LHC" made by Osmose or "Dricon" made by Koppers. Provide UL approve identification on treated materials.

2. For exterior blocking, roofing and sheet metal, pressure treat wood with water-borne, "CCA-Oxide: preservative complying with AWPB LP-2 (.23 lbs./cubic foot of chemical in wood).

   a. After treatment, kiln dry to a maximum moisture content of fifteen (15) percent. Treatment shall be equal to "Wolmanized" made by Koppers, or K33 made by Osmose, or approved equal.

3. Treated wood which is cut or otherwise damaged shall be further treated in accordance with the AWPA Standard M-4.

2.2 HARDWARE

A. Rough Hardware for Exterior Use: Hot-dipped galvanized aluminum or an approved non-ferrous metal.

B. Nails: Common steel wire, untreated for interior work as per Fed. Spec. FF-N-105.

C. Bolts: Standard mild steel, square head machine bolts with square nuts and malleable iron or steel plate washers or carriage bolts with square nuts and cut washers conforming to the following:

1. Bolts: FS-FF-B-575 and 584.

2. Nuts: FF-N-836D.

3. Expansion Shields: FS-FF-B-561.

4. Toggle Bolts: FS-FF-B-588.

5. Lag Screws and Bolts: FS-FF-B-561.

D. Wood Screws: Per Fed. Spec. FF-S-111D.

E. Concrete and Masonry Anchors: Standard expansion-shield self-drilling type concrete anchors where so shown or noted on the drawings, or where approved by the Architect.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where carpentry is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION OF FINISH HARDWARE

A. All finishing hardware specified in Section 08700 of this specification entitled "Finish Hardware" shall be received, accounted for, stored and applied under this Section.

B. Hardware shall be sorted and stored in space assigned by Contractor and shall be kept at all times under lock and key. The safety and preservation of all items delivered will be the responsibility of the Contractor.

C. Hardware shall be carefully fitted and securely attached, in accordance with these specifications and the instructions of the various manufacturers.

D. Unless otherwise noted, mount hardware units at heights established in Section 08100.

E. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

G. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

H. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

I. All keys used shall be construction keys which are to be tagged with fiber discs as approved, clearly labeled with identifying inscriptions and then neatly arranged in a temporary cabinet. All construction keys shall be returned to the Owner.

J. Adjusting and Cleaning

1. Adjust and check each operating item of hardware and each door, to ensure proper operation and function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

2. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make a final check and adjustment of all hardware items in such space or area. Clean and re-lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.3 INSTALLATION OF DOORS AND FRAMES

A. Steel Doors and Frames

1. Install hollow metal units and accessories in accordance with the final shop drawings, manufacturer's data, and as herein specified.

2. Setting Masonry Anchorage Devices

a. Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete and masonry construction.

b. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

3. Placing Frames: Prior to installation, all frames must be checked and corrected for size, swing, squareness, alignment, twist and plumbness. Permissible installation tolerances shall not exceed the following:

   a. Squareness +/- 1/16": Measured on a line, 90 degrees from one jamb, at the upper corner of the frame at the other jamb.
   b. Alignment +/- 1/16": Measured on jambs on a horizontal line parallel to the plane of the wall.
   c. Twist +/- 1/16": Measured at face corners of jambs on parallel lines perpendicular to the plane of the wall.
   d. Plumbness +/- 1/16": Measured on the jamb at the floor.
   e. In masonry construction, building-in of anchors and grouting of frames is included in Section 04200 of the specification.
   f. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
   g. At steel stud partitions, attach wall anchors to studs with tapping screws. Spot grout anchors with USG Durabond Joint Compound just before board is inserted into frame; coordinate with Section 09250.
   h. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
   i. Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.
   j. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

4. Door Installation: Fit hollow metal doors accurately in their respective frames, with the following edge clearances:

   a. Between Doors and Frames, at Head and Jambs: 1/8"
   b. At Door Sills Where No Threshold is Used: 3/8" max.
   c. At Door Sills Where Threshold is Used: 3/4" max. above finished floor.*
   d. Between Edges of Pairs of Doors: 1/8".
   e. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
   f. * Finished floor is defined as the top surface of the floor, except when resilient tile or carpet is used, when it is the top of the concrete slab. Where the carpet is more than 1/2" thick, allow 1/4" clearance.

B. Wood Doors

1. Condition doors to average prevailing humidity in installation area prior to hanging.

2. Install doors in accordance with manufacturer's instructions.

3. Fit door to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

4. Clearances: For non-fire doors provide clearances of: 1/8” at jambs and heads: 1/8” at meeting stiles for pairs of doors: and 1/2” from bottom of door to top of decorative floor finish or covering, except where threshold is shown or scheduled provide 1/4” clearance from bottom of door to top of threshold.

5. Fire-Rated Doors: Install in corresponding fire-rated frames in accordance with the requirements of NFPA No. 80. Provide clearances complying with the limitations of the authority having jurisdiction.

C. Adjustments: Check and readjust operating finish hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

3.4 BLOCKING AND MISCELLANEOUS WOOD

A. General

1. Erect rough carpentry true to line, levels and dimensions required; squared, aligned, plumbed, and securely fastened in place.

2. Shim where required to true up furring, blocking and the like. Use wood or metal shims only.

3. Do all cutting, fitting, drilling and tapping of other work as required to secure work in place and to perform the work included herein. Do all the cutting and fitting of carpentry work, for the work of other trades as required.

B. Blocking and Miscellaneous Wood

1. Furnish and install all wood grounds, furring, blocking, curbs, bucks, nailers, etc., that may be necessary and required in connection with the carpentry and with the work described for any other trades and including required carpentry for electrical fixtures. All blocking and nailers shall be continuous wherever required, whether or not so indicated.

2. Blocking shall be as required for the proper installation of the finished work and for items in mechanical sections as required. Blocking, edgings, stops, nailing strips, etc., shall be continuous, unless distinctly noted otherwise. Provide blocking as required to install all equipment. Provide blocking and nailers where shown or required to fasten interior sheet metal work.

3. Fastening for wood grounds, furring and blocking shall be of metal and of type and spacing as best suited to conditions. Hardened steel nails, expansion screws, toggle bolts, self-clinching nails, metal plugs, inserts or

similar fastenings shall be used, of suitable type and size to draw the members into place and securely hold same.

C. Rough Lumber for Roofing and Sheet Metal

1. Furnish and install all wood nailing strips and wood blocking required in connection with respective types of roofing, fans, flashings, and sheet metal work, using preservative treated wood as herein before specified.

2. Wood blocking shall be of sizes and shapes as indicated on the drawings and/or designed for the reception of curb flashings for roof ventilators and similar items.

3. All nailing strips and blocking shall be carried out in accordance with the printed installation instructions, and/or recommendations of the accepted manufacturer of the roofing materials, and in coordination and cooperation with the sheet metal work trades.

4. All blocking and nailing strips shall be firmly secured in place using counter bored bolt and nut fastenings, or secured by any other proposed flush surfaced fastenings.

5. Wood nailing strips or blocking required to be embedded in concrete work shall be furnished in time due for placing, prior to start of concrete operations. Locations and spacings of nailing strips or blocking shall be performed in coordination with the concrete trades, as required for respective installations.

3.5 TELEPHONE AND ELECTRIC EQUIPMENT MOUNTING BOARDS

A. Furnish and install 3/4” thick plywood panels to the walls of the telephone and electric equipment rooms in accordance with the requirements of the local utility company.

B. Secure to wall using proper devices for substrates encountered, spaced twelve (12) inches o.c., maximum around the edges, 1-1/2” from corners, and in three (3) rows of three (3) each in the field. Recess fastening devices flush with the plywood surface. Adjacent panels shall be butted with 1/16” space between without lapping.

3.6 ROUGH HARDWARE

A. Securely fasten rough carpentry together. Nail, spike, lag screw or bolt as required by conditions encountered in the field and the Contract Documents.

B. Provide rough or framing hardware, such as nails, screws, bolts, anchors, hangers, clips, inserts, miscellaneous fastenings, and similar items of the best quality and of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner.

C. Secure rough carpentry to masonry with countersunk bolts in expansion sleeves or other acceptable manner, with fastenings not more than sixteen (16)

inches apart. Secure woodwork to hollow masonry with toggle bolts spaced not more than sixteen (16) inches apart.

D. Countersink bolts in nailers and other rough woodwork and include washers and nuts. Cut bolts off flush with surfaces and peen as may be required to receive finished work.

E. Inserts to secure wood nailers to concrete shall be malleable iron threaded inserts with 3/8" diameter bolts of length to allow for countersinking. Locate at end of each nailer and at intervals not exceeding thirty (30) inches o.c.

F. Furnish to the mason for building into the work, or attaching the work which is to be built in, anchors, bolts, wall plates bolted to masonry, corrugated wall plugs, nailing blocks, etc., which are required for the proper fastening and installation for the work or other items as called for in this Section.

G. Detailed instructions with sketches of necessary requirements, shall be given to the masonry trade showing the location and other details of such nailing devices.

3.7 CLEANING UP

A. General: Keep the premises in a neat, safe and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends and debris.

B. Sweeping

1. At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.

2. Remove the refuse to the area of the job site set aside for its storage.

3. Upon completion of this portion of the work, thoroughly broom clean all surfaces.

END OF SECTION 062000

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SECTION 062020 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Plywood, Hardboard, Board paneling.
3. Shelving and clothes rods.
4. Interior stairs and railings.
5. Wall Base

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

B. Samples: For each type of paneling indicated.

1.3 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Interior standing and running trim.
2. Interior plywood, hardboard, board paneling.
3. Shelving and clothes rods.
4. Interior stairs and railings.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: AHA A135.4.

D. MDF: ANSI A208.2, Grade 130.

E. Particleboard: ANSI A208.1, Grade M-2.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. Lumber: Comply with performance requirements in AWPA C20, Exterior type. Kiln dry after treatment to a maximum moisture content of 19 percent.

B. Plywood: Comply with performance requirements in AWPA C27, Exterior type. Kiln dry after treatment to a maximum moisture content of 15 percent.

C. Application: All interior lumber and plywood.

2.3 STANDING AND RUNNING TRIM

A. Softwood Lumber Trim:

1. Species and Grade: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice)] Premium or 2 Common (Sterling)]; NeLMA, NLGA, or WWPA.
2. Species and Grade: Douglas fir-larch or Douglas fir south, Superior or C & Better finish; NLGA, WCLIB, or WWPA.
3. Species and Grade: Southern pine, B & B finish; SPIB.
4. Species and Grade: Western red cedar, [Clear Heart] [Grade A] [Grade B]; NLGA, WCLIB, or WWPA.
5. Maximum Moisture Content: 19 percent.

B. Hardwood Lumber Trim:

1. Species and Grade: Red oak, Clear A finish; NHLA.
2. Maximum Moisture Content: 13 percent.

C. Softwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA WM 4, N-grade wood moldings. Made to patterns included in WMMPA WM 12.

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine, Southern pine, Western red cedar, Douglas fir.
2. Maximum Moisture Content: 15 percent.

D. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA HWM 2, N-grade wood moldings made to patterns included in WMMPA WM 12.

1. Species: [Red oak] [White maple] [Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar] <Insert species>.
2. Maximum Moisture Content: 9 percent.

E. Moldings for Opaque Finish (Painted): Made to patterns included in WMMPA WM 12.

1. Softwood Moldings: WMMPA WM 4, P-grade.

    a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
    b. Maximum Moisture Content: 15 percent.

2. Hardwood Moldings: WMMPA HWM 2, P-grade.

    a. Species: Red oak.
    b. Maximum Moisture Content: 9 percent.

F. Molding Patterns: TBD

1. Base Pattern: WM 623, 9/16-by-3-1/4-inch (14-by-83-mm) ogee base.
2. Shoe-Mold Pattern: WM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round, shoe mold.
3. Casing Pattern: WM 327, 11/16-by-2-1/4-inch (17-by-57-mm) clamshell casing.
4. Chair-Rail Pattern: WM 297, 11/16-by-3-inch (17-by-76-mm) chair rail.

2.4 SHELVING AND CLOTHES RODS

A. Shelving: Made from one of the following materials, 3/4 inch (19 mm) thick.
1. MDF with solid-wood front edge.
2. MDO softwood plywood with solid-wood edge.
3. Softwood Boards: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice); NeLMA, NLGA, or WWPA; kiln dried.
4. Softwood Boards: Douglas fir-larch, Douglas fir south, or hem-fir; [Superior or C & Btr] [Prime or D] finish; NLGA, WCLIB, or WWPA; or southern pine, [B & B] [C] finish; SPIB; kiln dried.

B. Shelf Cleats: 3/4-by-3-1/2-inch (19-by-89-mm) boards with hole and notch to receive clothes rods, as specified above for shelving.

C. Shelf Standards: US 26 Polished chrome. Manufacurer, Reeve Co. Universal 40.

D. Shelf Brackets with Rod Support: US 26 Polished chrome. Manufacurer, Reeve Co. Universal 41.

E. Hangarbar: US 26 Polished chrome. Manufacurer, Reeve Co. Universal V425-2.

F. Rod:US 26 Polished chrome. Manufacurer, Reeve Co. Universal 225.

G. Rod Cap: Polished chrome. Manufacurer, Reeve Co. Universal 226-M

H. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.

I. Clothes Rods: 1-1/2-inch- (38-mm-) diameter, clear, kiln-dried hardwoodeither Douglas fir or southern pine.

2.5 STAIRS AND RAILINGS

A. Treads: White Oak - Quartersawn.

B. Risers: White Oak - Quartersawn.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work.
2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset.
4. Install stairs with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and with no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.

3.4 SHELVING AND CLOTHES ROD INSTALLATION

A. Cut shelf cleats at ends of shelves about 1/2 inch (13 mm) less than width of shelves and sand exposed ends smooth.

B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches (400 mm) o.c.

C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches (900 mm) o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

D. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.

3.5 STAIR AND RAILING INSTALLATION

A. Treads and Risers at Interior Stairs: Secure treads and risers by gluing and nailing to rough carriages.

1. Closed Stringers: House treads and risers into wall stringers, glue, and wedge into place.
2. Open Stringers: Miter risers and stringer at open stringers. Extend tread over open stringers and finish with bullnose edge.

B. Balusters: Mortise balusters into treads, secure in place. Let into railings and secure in place.

C. Newel Posts: Secure newel posts to stringers, rough carriages, and risers.

D. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with rail bolts. Assemble railings at goosenecks, easements, and splices with rail bolts.

END OF SECTION 062020

SECTION 064000 - ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the architectural woodwork as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Wood trim, moldings, base, frames.
2. Hardware for casework.
3. Wood shelving.
4. Wood framing and rough lumber as required for work of this Section.
5. Wood grounds, blocking, nailers, furring as required for work of this Section.
6. All rough hardware and fastenings for work of this Section.
7. Drilling concrete and masonry, drilling and/or tapping metal work, as required, for the installation of work of this Section.
8. Back painting as specified herein.
9. Shop finish of work of this Section, except items indicated herein to be shop primed only.

1.3 RELATED SECTIONS

A. Rough Carpentry - Section 06200.

B. Wood doors - Section 08211.

C. Painting - Section 09910.

D. Residential Casework – Section 123560

1.4 QUALITY STANDARDS

A. The quality standards of the Architectural Woodwork Institute, latest edition, shall apply to all workmanship for architectural woodwork and by reference are made a part of this specification. All work shall conform to “Premium” grade requirements of the AWI Quality Standards, unless otherwise modified herein.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. In the event of a dispute as to the quality grade (or grades), all parties involved will (1) call upon the Architectural Woodwork Institute for an inspection under AWI's established inspection procedures, and (2) agree to abide by the decision of AWI. The cost of said inspection shall be borne by the Contractor.

D. Employ only tradesmen experienced in the fabrication and installation of architectural woodwork.

E. All woodwork will be in compliance with California 93210 Phase 2 requirements.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings of all woodwork specified and indicated on the drawings. Shop drawings shall indicate room plans and elevations at 3/4" equals 1'-0" scale and typical construction details at 3" equals 1'-0" scale. Shop drawings shall indicate all materials, thicknesses and finishes.

2. Shop drawings shall show all finish hardware, anchors, fastenings and accessories.

3. Shop drawings shall show all jointing, joint treatment and butt jointing in veneers and plastic laminate.

4. Shop drawings for wood paneling must show complete elevations of rooms to receive paneling as well as panel matching required by these specifications.

B. Samples: Submit samples of each of the following items:

1. Plastic laminate, twelve (12) inches square, including a section of outside corner.

2. Each finish type of wood panel, 24" wide x 36" high.

3. Each type and finish of each type of trim molding, etc., eight (8) inches long, finish as specified.

4. Cabinet hardware.

1.6 QUALIFICATIONS

A. The work of this Section shall be provided by a firm having a minimum of five (5) years experience on projects of similar size and quality to that specified and shown.

1.7 COORDINATION

A. Coordinate the work of this Section with other appropriate Sections of the specifications to insure proper scheduling for fabrication and installation of the work specified herein

B. Coordinate with partition and finish trades to insure that proper provisions are made for the installation of the work specified herein.

C. Verify all dimensions in the field prior to fabrication of all Architectural Woodwork to assure proper fit.

1.8 PRODUCT HANDLING

A. All materials and work of this Section shall be protected from damage, from time of shipment from shop to final acceptance of work. Cover, ventilate, and protect work of this Section from damage caused by weather, moisture, heat, staining, dirt, abrasions, any other causes which may adversely affect appearance of use, or which may cause deterioration of finish, warping, distortion, twisting, opening of joints and seams, delamination, loosening, etc., of work of this Section.

B. Keep all finish carpentry, millwork, and cabinet work under cover both in transit and at the premises. Do not deliver any finish carpentry, millwork or cabinet work before it is required for installation. Protect such work to avoid damage in transit, during erection and after erection until acceptance of the building; use all such methods to provide the proper protection. Remove such protection when directed by the Architect.

C. Deliver finish carpentry, millwork, and cabinet work in a dry stable condition; protect same against injury and dampness. Do not store or install finish carpentry, millwork or cabinet work until after the concrete, masonry and plaster work are thoroughly dry.

D. Damaged or defective items or work of this Section are subject to rejection and replacement with new by Contractor, at no cost to Owner.

1.9 JOB CONDITIONS

A. Humidity and Temperature Controls: Advise Contractor of requirements for maintaining heating, cooling and ventilation in installation areas as required to reach relative humidity necessary to maintain optimum moisture content specified for woodwork.

B. Determine equilibrium moisture content and maintain required temperature and relative humidity as required for a tolerance of plus or minus one (1) percent of the specified optimum moisture content until woodwork receives specified finishes. Refer to “Guide to Wood Species Selection”, AWI, for method of determining equilibrium moisture content values.

C. Examination of Substrate and Conditions: The installer must examine the substrate and the conditions under which the work of this Section is to be

performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with work under this Section until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

PART 2 PRODUCTS

2.1 BASIC REQUIREMENTS

A. Available Products: Subject to compliance with requirements, woodwork that may be incorporated into the Work include, but are not limited to the following:

1. Armstrong

B. Wood Moisture Content: Provide kiln-dried (KD) lumber with an average moisture content range of nine (9) to twelve (12) percent for exterior work and six (6) to eleven (11) percent for interior work. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed seven (7) percent.

C. Measurements: Before proceeding with woodwork required to be fitted to other construction, obtain field measurements and verify all dimensions of shop drawing details as required for accurate fit.

D. Compatibility of Grain and Color: Architect reserves the right to select materials for best compatibility between visually related members and veneers.

E. Machine and sand woodwork to comply with requirements of Standards for specified grade.

F. Fabricate woodwork to dimensions, profiles and details shown. Route or groove back of flat trim members, kerf backs of other wide flat members except plywood or veneered members.

G. Miter joints by joining, splining and gluing to comply with requirements for the specified grade.

H. Inspect each piece of lumber and plywood or each unit of woodwork after drying; do not use twisted, warped, bowed of otherwise damaged or defective wood.

2.2 GENERAL - MATERIALS

A. Softwood lumber shall conform to the requirements of the latest edition of American Lumber Standards Simplified Practice Recommendation R-16. Grades shall conform to the grading rules of the Association having jurisdiction, and shall bear the official grade and trademark of the Inspection Bureau of the Association and a mark of mill identification.

B. Framing and Rough Lumber: No. 1 KD grade Southern Pine or Dense Construction grade Douglas Fir, having extreme fiber in bending stress of at

least 1700 psi, surfaced four sides (S4S). Provide fire retardant treatment meeting requirements of Section 06200.

C. Grounds, Blocking, Nailers, Furring: Southern Pine, Douglas Fir or Sitka Spruce, grade to suit particular purpose and to be straight, square edged, straight grained, surfaced four sides (S4S), and which will retain nails and screws without splitting. Provide fire retardant treatment.

D. Lumber: AWI Section 100 with the following requirements:

1. Hardwood for Transparent Finish: Premium Grade, select Quarter Sawn Oak matching adjoining veneers unless otherwise shown or specified, and free from cat's eyes, bird's eyes, burls, curls or cross grains.

2. Hardwood for Opaque Finish: Any hardwood which, when finished, will not show any grain, imperfection or other surface defects when used with the opaque finish specified.

E. Plywood: AWI Section 200; Veneer core, particle or plywood core unless otherwise specified, and with the following requirements:

1. Hardwood: Premium Grade, Section 200, face veneers as shown or specified

2. Particle Board: Premium Grade, Section 200, fire retardant for wall paneling only equal to Duraflake FR and Duraflake for cabinets.

3. Edges: Banded with hardwood in accordance with Premium Grade Standards.

F. Veneers

1. Face Veneers for Transparent Finish: AWI Section 500, Premium Grade of species. Veneer must be sequence matched, book matched, end matched and centered balanced.

2. Face Veneers for Opaque Finish: Any closed grain hardwood veneer that, when finished, will not show grain, imperfection or other surface defects when used with the opaque finish specified.

G. Finishing (Wood)

1. Transparent Finish for Paneling, Casework and Trim

a. AWI Factory Finish System No. as selected by Architect.
b. AWI Premium Grade.
c. Stain: as selected by Architect.
d. Degree of Sheen: as selected by Architect.
e. Filled or Unfilled Finish.
f. Premium grade.

2.3 METAL

A. Steel

1. Structural Steel Shapes and Plates: ASTM A36.

2. Hot-Rolled Carbon Steel Sheets: Commercial quality, ASTM A569, may be used for concealed parts only. Galvanize sheets for planters.

3. Finishes

a. Primer for Unexposed Metal: Zinc chromate primer.

2.4 GLASS

A. Comply with the requirements of Section 08800

2.5 MISCELLANEOUS PRODUCTS

A. Fasteners

1. Wood Screws: FS FF-S-111, type, size, material and finish as required for the condition of use.

2. Nails: FS FF-N-105, type, size, material and finish as required for the condition of use.

3. Anchors: Type, size, material and finish as required for the condition of use.

4. Staples: Upholstery type staples of sufficient strength to hold fabric taut in place without sagging.

B. Adhesives

1. For Laminating Plastic Laminate Surfaces: Melamine, phenol-resin, or resorcinol-resin complying with FS MMM-A-181; type, grade and best suited for the purpose.

2. For All Other Uses: Moisture resistant complying with FS MMM-A125, Type II, or MMM-A-188, Type I II or III.

C. Provide thermal insulation within radiator enclosures.

2.6 CABINET HARDWARE

A. Architectural Woodwork Hardware: Provide the following items, or their approved equal, as required:

1. Hinges: Hafele concealed hinges.

2. Catches: Magnetic; top and bottom.

3. Pulls: Selected by the Architect.

4. Locks: Selected by the Architect.

5. Drawer Slides: Accuride, Model 7434, full extension, 100 lb. capacity.

6. Shelf Supports: Pin and grommet system equal to No. 282.01.701 pin and 282.50.704 grommet made by Hafele.

7. Finish: Satin Stainless Steel.

8. Closet Hardware: Oval wardrobe rails, chrome plated steel with center bracket and wall support brackets made by Hafele or approved equal.

2.7 WOOD FOR RAILS, CAPS, TRIM, BASES, MOULDINGS AND FRAMES

A. Quality Standard: For the following types of interior architectural woodwork, comply with indicated standards as applicable.

1. Standing and Running Trim: AWI Section 300.

2. Miscellaneous Millwork: AWI Section 700.

3. Stair Handrails: AWI Section 800.

B. Wood Work for Transparent Finish: Except as otherwise indicated, comply with the following:

1. Grade: Premium.

2. Species of Solid Wood: Quarter Sawn White Oak as noted on drawings.

C. Woodwork for Paint Finish: Except as otherwise indicated, comply with the following:

1. Grade: Premium.

2. Species of Solid Wood: Solid, paint grade, sound clear Poplar or Birch.

2.8 FABRICATION - GENERAL

A. Provide lumber framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.

B. Do all fabrication from field measurement with provision for scribing as required to meet built-in conditions.

C. Coordinate the work of this Section with the work of other trades.

D. Fabricate units in largest practicable sections. Assemble in the shop for trial fit, disassemble for shipment and reassemble with concealed fasteners.

E. Maintain relative humidity and temperature during fabrication, storage and finishing operations matching that of the areas of installation.

F. Details indicate the required type and quality of construction. Modifications to conform to manufacturer's standards will be considered providing they comply with the Contract Documents, maintain the profiles shown and subject to acceptance by the Architect.

G. Reinforcing shown is minimum. Provide additional reinforcing as required to ensure a rigid assembly. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints, or other defects affecting serviceability or appearance. Accurately fit all joints, corners and miters. Conceal all fasteners. Make threaded connections up tight so that threads are entirely concealed.

H. Factories finish all items where possible. Defer final touch-up, cleaning and polishing until after delivery and installation.

I. Comply with AWI Section 1500, Premium Grade for sanding, filling countersunk fasteners, back priming and similar preparations for the finishing of architectural woodwork, as applicable to each unit of work.

J. Prepare all countersunk wood screw attachments for wood plugs. Wood plugs shall match surrounding species and grain direction, putty filling is not acceptable.

2.9 FABRICATION - SPECIFIC ITEMS

A. Casework

1. Provide casework in accordance with AWI Section 400, Premium Grade.

2. Include all preparations for mechanical, electrical, telephone and plumbing work required.

3. Provide cabinet hardware for casework as shown.

4. Provide dust panels in body webs and between drawer units.

5. Provide wood veneers for exposed surfaces as specified herein before.

6. Hollow core doors will not be permitted.

7. Provide matching veneers for edge treatments of case body members where transparent finishes are indicated or specified.

8. Provide drawers with slides as specified. Drawers shall not rest on web body frames.

9. Provide wood veneers for transparent finish, of matching and continuing grain, for drawer and door edges.

B. Closet and Storage Shelving

1. Provide closet and storage shelving in accordance with AWI Section 600, Custom Grade, unless otherwise shown or specified.

2. Exposed edges shall have hardwood edge bands.

C. Standing and Running Trim

1. Provide standing and running trim of the sizes, profiles, species and finish as specified or shown and complying with AWI Section 300, Premium Grade.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where architectural woodwork is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 FRAMING

A. Use specified framing lumber, sizes and spacing as indicated on drawings and as required to support loads.

B. Framing shall be cut square on bearings, closely fitted, accurately set to required lines and levels, rigidly secured in place at bearings and connection with nails, lag screws and/or bolts as required by conditions.

3.3 GROUNDS, BLOCKING, NAILERS AND FURRING

A. Provide all wood grounds, blocking, nailers, furring, and the like for work of this Section, where shown and where required, dressed to size indicated or required to suit the condition. Install grounds, blocking, nailers, furring, etc., rigidly, in proper alignment, trued with a long straight edge.

3.4 ROUGH HARDWARE

A. Provide all rough hardware, such as nails, screws, bolts, anchors, hangers, clips and similar items. Hardware shall be of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner. Use galvanized hardware at exterior walls, and at other locations where subject to moisture or where water will be present.

B. Secure wood to concrete and to solid masonry with countersunk bolts in expansion sleeves or other approved manner, to steel with countersunk bolts, to hollow masonry and to drywall with heavy duty countersunk toggle bolts. Space fastenings not more than sixteen (16) inches apart. Hardened cut nails, power-driven fastenings, or other suitable devices may be used where approved by the Architect.

C. Connections and fastenings shall be made in such manner as will compensate for swelling and shrinkage and shall permit the work to remain permanently in place without any splitting or opening of joints.

3.5 INSTALLATION OF CABINET FINISH HARDWARE

A. All items of finish hardware furnished under this Section shall be carefully fitted and secured in place as part of the work of this Section. Locations and positioning of hardware shall be subject to the Architect's approval. Care shall be taken not to mar or damage hardware, or other work. Install doors plumb and true. Hardware shall be fitted to assure operation without forcing.

B. After preliminary fitting of hardware, the Contractor shall remove trim for painting and finishing work; after which he shall reinstall the hardware in a permanent manner.

C. Upon completion of the work, before final acceptance of the building by the Owner, the Contractor shall, in the presence of the Architect, show that all hardware is in satisfactory working order; fit all keys in their respective locks and, upon acceptance of the work, shall tag and deliver all keys to the Owner.

D. When directed by the Owner, at any time during the first year after the completion of the Contract, the Contractor shall return to the building and adjust and refit the work and hardware, and leave such items in satisfactory working order.

3.6 GENERAL INSTALLATION

A. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops), and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offset in revealed adjoining surfaces.

B. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

C. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

3.7 TRIM, MOULDINGS, ETC.

A. Install with minimum number of joints possible, using full length pieces for each run. Stagger joints in adjacent and related members. Cope at returns, miter corner.

B. Joints of all trim and/or moldings shall be set tight, miter exterior angles and cope interior angles. Joints, except end joints less than twelve (12) feet apart, will not be permitted in straight runs of trim and/or moldings and rails.

C. Secure all trim and/or moldings with glue and blind nail with finishing nails. Set exposed nail heads in finished work and putty. Sand all work to remove any tool marks and irregularities.

D. Wood shall receive finish as specified in Section 09900 - Painting.

3.8 WOOD RAILS

A. Wood shall be planed straight, square and level, then sanded smooth with flush finished surfaces. Joints shall occur over supports. Right angle joints shall be mitered.

B. All exposed fastening devices shall be countersunk and set below finished wood surfaces, and fitted with matching wood plugs; sand plugs and finish smooth and flush with exposed surfaces.

C. Handrails shall be capable of withstanding a force of two hundred (200) lbs. applied to rail at any point from any direction.

D. Provide all hardware and metal supports required for complete installation as detailed on drawings.

3.9 CLOSET AND STORAGE SHELVING

A. Provide storage closet and wood shelving. Provide metal hang rods. Set adjustable center hangers. Provide linen closet and (5) five wood shelves.

3.10 CABINET WORK AND MILLWORK

A. General

1. Materials and workmanship shall conform to the Quality Standards of the Architectural Woodwork Institute specified herein and to the drawings.

2. Cabinet work and millwork shall be performed by experienced cabinet work and millwork company, having craftsmen skilled in their trade.

3. Fabricate all cabinet work and millwork completely in the shop, in complete and/or as large units as practical, leaving only fitting, assembly, installation and a minimum of fabrication and finishing to be done at the building. Assembled work shall be rigidly secured and permanently fastened together with concealed fasteners.

4. As far as practicable, use concealed fastenings for joining and assembling the work.

5. Mill all finish wood accurately to detail, with clean cut moldings, profiles and lines, machined, sanded smooth, housed, jointed, blocked, put together in the best manner, with provision for swelling and shrinkage, and to assure the work remaining in place without warping, splitting or opening of joints.

6. Cut trim to dimensions and profiles shown, from solid stock.

7. Make all trim and the like in single lengths wherever possible; joints mitered, glued and splined. Continuous members shall have tight flush joints, doweled or splined and glued.

8. Make all joints hairline tight, fitted accurately and joined with hardwood splines or dowels, glued together.

9. Gluing shall, where practicable, be by the hot plate press method and glued surfaces shall be in close contact throughout. Glue stains on finished work will not be permitted.

10. Cover surface fastenings, where permitted, with matching wood plugs or wood putty. Finish exposed edges of plywood with matching solid stock. Lock miter external corners; tongue and groove internal corners to allow for contraction and expansion.

11. Machine sand with grain, finish with hand sanding, leave exposed surfaces free from machine or tool marks that will show through the finish.

12. Work which adjoins drywall, concrete, or other finish shall be fitted and scribed in a careful manner and ample allowance shall be given for cutting and scribing.

13. Erect work true to lines, levels and dimensions, square, aligned and plumb, securely and rigidly fastened in place.

B. Cabinet Work: Provide all items of cabinet work indicated on drawings and as herein specified.

1. Tops, sides, backs, bottoms, dividers, shelves, fronts, doors and drawer fronts shall be of plywood or flakeboard core, with the specified wood veneer or plastic laminate as indicated on drawings.

2. Drawer sides and backs shall be 1/2” thick solid clear selected white birch, suitable for clear finish. Drawer bottom shall be 3/8” thick plywood with clear selected white birch veneers, suitable for clear finish.

3. Cabinet doors and drawers shall be flush mounted.

4. Adjustable shelves in cabinets shall have grommets spaced 2" o.c.

5. Fixed shelves shall be dadoed into side supports and glued.

6. Shelves shall be 3/4” thick for spans up to 30"; for spans in excess of 30" to 48" shelves shall be 1" thick.

7. All cabinets shall have closed top, sides, bottom, and back with veneers to match face work. Cabinets to fit accurately into indicated locations; scribe moldings permitted only where indicated.

8. Countertops, counters, counter fronts, shelves, etc., indicated on drawings to have plastic laminate, shall have plastic laminate shop applied to 3/4”

thick core, with plastic laminate backing sheet on underside or back of countertops, counters and shelves. Plastic laminate shall be pressure laminated to core with laminate at external corners. Provide concealed wood framing to support plastic laminate counters, securely fastened to wall and to underside of counters.

3.11 WOOD BASES

A. Provide plywood backing, toggle bolted to substrate, if substrate not suitable for securing wood base.

B. Machine wood bases from specified wood, to profiles indicated on drawings.

C. Set base level and plumb. Where indicated on drawings, face of wood base shall be flush with wall above. Glue wood base to substrate or to plywood backing, and screw or nail wood base to substrate or to plywood backing with countersunk wood screws or with finishing nails, recess wood screw heads, and spackle with wood putty, set and spackle nails with wood putty. Do not nail or fasten wood base to floor. Ends of wood base shall be either splined or ship lapped.

D. Where no wood backing occurs, screw apply base at each stud with screw countersunk and wood putty applied and sanded smooth and flush with base.

3.12 PAINTING AND FINISHING

A. General: All painting and finishing work of this Section shall be shop applied, unless otherwise noted, as specified below. All painting and finishing shall match approved samples. Field finish painting, where specified below, shall be by painting Subcontractor, as specified for in Painting Section.

B. Schedule of Painting and Finishing

1. Shop Primer On:

a. Wood bases.
b. Wood trim and moldings to be field finish painted.
c. Ferrous metal work.

2. Shop Natural Finish On:

a. Wood paneling.
b. Wood cabinets with wood veneers.

C. Back-Painting: All work of this Section in contact with concrete or masonry or other moisture areas and all concealed surfaces of cabinet and millwork, shall be back-painted with one (1) coat of oil based paint prior to installation, shop applied where practicable.

D. Field Touch-Up: Field touch-up shall be the responsibility of the installing Subcontractor, and shall include the filling and touch-up of exposed job made

nail or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and mars, and final cleaning up of the finished surfaces.

3.13 CLEAN UP AND PROTECTION

A. Clean Up: At regular intervals during the course of the work, all debris and excess material shall be cleaned up and removed from the site. Upon completion of installation, clean all spaces of debris caused by woodwork installation.

B. Protection: Protect all woodwork from marring, defacement of other damage until final completion and acceptance of the project by the Owner. Repair or replace all defective units prior to final inspection as directed by the Architect. Any units that cannot be satisfactorily repaired in the opinion of the Architect shall be replaced with new units of same original design, at no additional cost to the Owner.

END OF SECTION 064000

SECTION 072100 – THERMAL AND SOUND INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Roof insulation.
   2. Concealed building insulation except cavity wall phenolic insulation.
   3. See phenolic insulation section for above grade exterior wall insulation.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Product test reports.

C. Research/evaluation reports.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

B. Roofing: GenFlex CG ISO closed cell polyisocyanurate foam core, bonded chemically to a heavy duty, dimensionally stable, inorganic, double coated glass facer. Offering a Class A fire rating over combustible decks at 1” thick and meeting D3273 standards for mold resistance, this lightweight insulation is compatible with all roofing systems including GenFlex EPDM and GenFlex EZ TPO Membranes and provides enhanced wind uplift performance for your roofing system. GenFlex Coated Glass Facer is also available in tapered to provide a sloping surface. Tapered polyiso promotes positive drainage for roofing applications. R 5.0 per inch min. with maximum flame-spread and smoke-developed indices of 25 and 450, respectively. Joints taped and sealed per manufacturers recommendation.

- Compressive Strength, ASTM D1621, 25 psi min.
- Water Absorption, ASTM 6209, 0.1% by volume.
- Water Vapor Permeance, ASTM E96, 0.03 perms maximum.

C. Mineral-fiber blanket sound attenuation insulation.

1. Type: Faced mineral fiber acoustical insulation complying with ASTM C 665, Type I.
2. Size: Thickness, see partition schedule. Surface Burning Characteristics: When tested in accordance with ASTM E 84.
   a. Maximum flame spread: 25
   b. Maximum smoke developed: 50
4. Combustion Characteristics: Passes ASTM E 136.
5. Fire Resistance Ratings: Passes ASTM E 119 as part of a complete fire tested wall assembly.
6. Sound Transmission Class: STC see plans. Dimensional Stability: Linear Shrinkage less than 0.1%

2.2 VAPOR RETARDERS

A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm. See Section 2 for slab on grade vapor barriers.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.3 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Protection Board: Premolded, semirigid asphalt/fiber composition board, 1/4 inch thick minimum, formed under heat and pressure, of standard sizes.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors with Washers: Plate formed from perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square, welded to projecting steel spindle with a diameter of 0.105 inch and length capable of holding insulation of thickness indicated securely in position with 1-1/2- inch- square or diameter self-locking washers complying with the following:

1. Washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than in place.
2. Where anchors are located in crawlspaces provide capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.

B. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain 1-inch air space between face of insulation and substrate to which anchor is attached.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates shown without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install insulation to comply with insulation manufacturer's written instructions applicable to products and application indicated. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

B. Install perimeter insulation on vertical surfaces by setting units in adhesive.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
2. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board set in adhesive.

C. Protect top surface of perimeter under-slab insulation from damage during concrete work by applying protection board.

D. Pour granular insulation into cavities indicated to receive insulation, taking care to fill voids completely. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close ports after confirming complete coverage. Limit fall of insulation to one story in height, but not exceeding 20 feet.

E. Installation of General Building Insulation: Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

1. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant.
2. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

    a. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

3. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

a. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
b. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

4. For metal-framed wall cavities where cavity heights exceed 96 inches support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
5. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
6. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.
7. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

F. Installation of Vapor Retarders: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

1. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
2. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.
4. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
5. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

END OF SECTION 072100

SECTION 072110 - MINERAL WOOL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Mineral wool insulation for the following applications:
   1. Thermal and acoustical insulation.
   2. Perimeter fire containment systems.
   3. Fire resistive joint systems in rated assemblies.
   4. Firestopping of through penetrations in rated assemblies.

B. Related Sections:
   1. Section 07 10 00 - Damp proofing and Waterproofing Systems:
   2. Section 07 24 00 - Exterior Insulation and Finish Systems: Insulation for EIFS systems.
   3. Section 07 50 00 - Membrane Roofing: Insulation in low-slope roofing applications.
   4. Section 07 84 00 – Penetration Firestopping.
   5. Section 23 07 00 - HVAC Insulation: Insulation for HVAC ductwork.
   6. Section 09 21 16 – Gypsum Board assemblies.

1.2 SUBMITTALS

A. Product Data: Submit product data including manufacturer's literature for insulation, including preparation instructions and recommendations, installation methods, and storage and handling requirements.

B. Recycled Content: For projects looking for LEED certification or other sustainable design program, submit letter from material supplier indicating, thermal value of insulation contributing to overall energy performance of building, recycled content of insulation indicating percentages by weight of preconsumer and postconsumer recycled content, location where insulation is extracted, processed and manufactured.

C. Regionally Manufactured Materials: For projects looking for LEED certification, submit documentation indicating location of manufacturer and percent of raw materials. Include cost and distance from the manufacturer to project for each regionally manufactured material and percent of raw materials used to make product within 100 miles of project site.

D. Verification Samples: Submit sample of insulation in thickness used on Project.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Work experience of 2 years minimum with work similar to work on this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials and accessories in insulation manufacturer's original packaging with identification labels intact and in sizes to suit project. Ensure insulation materials are not exposed to moisture during delivery. Replace wet or damaged insulation materials.

B. Storage and Handling: Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacture. Store in original packaging until installed.

C. Packaging Waste Management: Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycle.

1.5 WARRANTY

A. Warranty: Refer to Contract Conditions for project warranty provisions.

PART 2 - PRODUCTS

2.1 MANUFACTURER

1. Basis-of-Design Manufacturer: ROCKWOOL (US)
   4594 Cayce Drive Byhalia, MS 38611
   1-877-823-9790 or at www.rockwool.com
2. Approved Equal

2.2 THERMAL AND ACOUSTICAL INSULATION

A. Thermal / Acoustical Insulation:

1. Product: ROCKWOOL Comfortbatt for Wood Stud; unfaced.
   a. R-Value: R-15, R-23, R-30
   b. Density: > 2 lbs/ft^2 (>32 kg/m^3), nominal.
   c. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   d. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
   e. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   f. Fungi resistance: Zero mold growth to ASTM C1338
   g. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   h. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   i. GREENGUARD Gold Certified

2. Product: ROCKWOOL Comfortbatt for Steel Stud; unfaced.
   a. R-Value: R-10, R-15, R-24,
   b. Density: > 2 lbs/ft³ (>32 kg/m³) nominal.
   c. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   d. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
   e. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   f. Fungi resistance: Zero mold growth to ASTM C1338
   g. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   h. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   i. GREENGUARD Gold Certified

3. Product: ROCKWOOL Acoustical Fire Batts (AFB) for Steel Stud; unfaced.
   a. Density: >2.5 lbs/ft³ (>40 kg/m³), nominal.
   b. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   c. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   d. Non-combustible: classified non-combustible per CAN/ULC S114
   e. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   f. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
   g. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   h. Fungi resistance: Zero mold growth to ASTM C1338
   i. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   j. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   k. Air Erosion: maximum air velocity of 1,000 fpm (5.08 m/s) per UL 181
   l. UL Classification Code: BZJZ
   m. ULC Classification Code: BZJZC
   n. GREENGUARD Gold Certified
   o. MEA Approval, New York City Approval – 338-97-M
   p. City of Los Angeles Approval – RR 25444

4. Product: ROCKWOOL Acoustical Fire Batts (AFB) for Wood Stud; unfaced.
   a. Density: >2.5 lbs/ft³ (>40 kg/m³), nominal.
   b. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   c. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   d. Non-combustible: classified non-combustible per CAN/ULC S114
   e. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   f. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.

g. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
h. Fungi resistance: Zero mold growth to ASTM C1338
i. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
j. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
k. Air Erosion: maximum air velocity of 1,000 fpm (5.08 m/s) per UL 181
l. GREENGUARD Gold Certified
m. MEA Approval, New York City Approval – 338-97-M
n. City of Los Angeles Approval – RR 25444

5. Product: ROCKWOOL Acoustical Fire Batts evo (AFB evo Formaldehyde Free) for Steel Studs; unfaced
   a. Density (nominal):
      1) Less than 3", density 2.5 lbs/ft³ (40 kg/m³).
      2) Greater than 3", density 2.2 lbs/ft³ (38 kg/m³).
   b. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   c. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   d. Non-combustible: classified non-combustible per CAN/ULC S114
   e. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   f. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
   g. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   h. Fungi resistance: Zero mold growth to ASTM C1338
   i. Linear Shrinkage at 1472°F (800°C): Average linear shrinkage in all dimensions not to exceed 15% when tested to ASTM C356 at 1472°F (800°C).
   j. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   k. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   l. Formaldehyde Free (FF) - certified by UL Environment (ULE) Claim Validation
   m. UL Classification Code: BZJZ
   n. ULC Classification Code: BZJZC
   o. GREENGUARD Gold Certified
   p. DECLARE Certified
   q. ULE Validated Formaldehyde Free

B. Rain Screen / Cavity Wall Continuous Insulation

1. Product: ROCKWOOL Cavityrock and Cavityrock Black, semi-rigid stone wool insulation boards designed for exterior cavity wall and rainscreen applications
   a. R-value: 4.3 /inch at 75°F.
   b. Facing (Cavityrock): Unfaced
   c. Facing (Cavityrock Black): Black Mat

d. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
e. Surface Burning Characteristics: Tested in accordance with ASTM E84
   1) Unfaced: Flame Spread 0 and Smoke Developed 0
   2) Faced: Flame Spread 10 and Smoke Developed 25
f. Monolithic Density (Thickness: 1", 1.5", 2"): > 4.3 lbs/ft³ (>69 kg/m³), nominal.
g. Dual Density (Thickness: ≥ 2.5"): 6.2 lbs/ft³ (100 kg/m³) outer layer and 3.8 lbs/ft³ (61 kg/m³) inner layer, nominal..
h. Dual Density: Must have dual densities for all thicknesses greater than or equal to 2.5".
i. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
j. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
k. Fungi resistance: Zero mold growth to ASTM C1338
l. Linear Shrinkage at 1200°F (650°C): Average linear shrinkage in all dimensions not to exceed 0.7% when tested to ASTM C356 at 1200°F (650°C).
m. Tumbling Friability: Material loss not to exceed 15% when tested to ASTM C421 – Standard Test Method for Tumbling Friability of Preformed Block-Type Thermal Insulation.
n. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
o. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
p. DECLARE Certified

2. Product: ROCKWOOL Comfortboard 80, rigid exterior non-structural mineral wool insulation sheathing board that is non-combustible, water-repellent, fire-resistant and sound absorbent and provides a continuous layer of insulation around the commercial or residential building envelope.
   a. R-value: 4.2 /inch at 75°F.
   b. Cladding Attachment Method: Screw-through Method.
   c. Cladding Weight: Refer to Manufacturer's Cladding Attachment and Support Guidelines
   d. Facing: Unfaced.
   e. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   f. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   g. Density: 8.0 lbs/ft³ (128 kg/m³), actual.
   h. Compressive Strength: 439 lbs./ft^2 (21kPa) @ 10% compression; 1065 lbs./ft^2 (50kPa) @ 25% compression
   i. Moisture Resistance: Absorption of less than 0.05% by volume when tested in accordance with ASTM C1104
   j. Vapor Permeability: 31 perm when tested in accordance with ASTM E96.
   k. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   l. Fungi resistance: Zero mold growth to ASTM C1338

m. Linear Shrinkage at 1200ºF (650ºC): Average linear shrinkage in all dimensions not to exceed 0.7% when tested to ASTM C356 at 1200ºF (650ºC).
n. Listed with California Office of the State Fire Marshal (Cal Fire) Building Material Listing Service
o. Breaking Load and Flexural Strength (Thickness: 2"): Minimum 200 kPa when tested to ASTM C203.
p. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
q. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
r. DECLARE Certified

3. Product: ROCKWOOL Comfortboard 110, rigid, high density exterior non-structural mineral wool insulation sheathing board that is non-combustible, water-repellent, fire-resistant and sound absorbent and provides a continuous layer of insulation around the commercial or residential building envelope.
   a. R-value: 4.0 /inch at 75ºF.
   b. Cladding Attachment Method: Screw-through Method.
   c. Cladding Weight: Refer to Manufacturer's Cladding Attachment and Support Guidelines
   d. Facing: Unfaced.
   e. Melting Point – Minimum melting point temperature of 1177ºC (2150ºF).
   f. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   g. Density: 11.0 lbs/ft³ (176 kg/m³), actual.
   h. Compressive Strength: 584 lbs./ft^2 (28kPa) @ 10% compression; 1566 lbs./ft^2 (75kPa) @ 25% compression
   i. Moisture Resistance: Absorption of less than 0.05% by volume when tested in accordance with ASTM C1104
   j. Vapor Permeability: 35 perm when tested in accordance with ASTM E96.
   k. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   l. Fungi resistance: Zero mold growth to ASTM C1338
   m. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   n. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   o. DECLARE Certified

C. Multi-Purpose Thermal and Acoustical Insulation Products:

1. Product: ROCKWOOL ROCKBOARD 40, non-combustible, semi-rigid, multi-purpose mineral wool insulation board, water repellent.
   a. R-value: 4.2 /inch at 75ºF.
   b. Facing: Unfaced
   c. Facing: Black Mat
   d. Melting Point – Minimum melting point temperature of 1177ºC (2150ºF).
   e. Surface Burning Characteristics: Tested in accordance with ASTM E84

1) Unfaced: Flame Spread 0 and Smoke Developed 0
2) Faced: Flame Spread 25 and Smoke Developed 10

f. Complies with ASTM C612 Type IVA
g. Density: 4.0 lbs/ft³ (64 kg/m³), actual.
h. Compressive Strength: 90 lbs./ft^2 (4.3kPa) @ 10% compression; 225 lbs./ft^2 (10.8kPa) @ 25% compression
i. Air Erosion: Maximum Air Velocity 1000 fpm (5.08 m/s) per UL 181
j. Moisture Resistance: Absorption of less than 0.05% by volume when tested in accordance with ASTM C1104
k. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
l. Fungi resistance: Zero mold growth to ASTM C1338
m. Linear Shrinkage at 1200ºF (650ºC): Average linear shrinkage in all dimensions not to exceed 1% when tested to ASTM C356 at 1200ºF (650ºC).
n. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
o. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.

2. Product: ROCKWOOL ROCKBOARD 60, non-combustible, rigid, multi-purpose mineral wool insulation board, water repellent.
   a. R-value: 4.3 /inch at 75ºF.
   b. Facing: Unfaced
   c. Melting Point – Minimum melting point temperature of 1177ºC (2150ºF).
   d. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   e. Complies with ASTM C612 Type IVB
   f. Density: 6.0 lbs/ft³ (96 kg/m³), actual.
   g. Compressive Strength: 355 lbs./ft^2 (17kPa) @ 10% compression; 585 lbs./ft^2 (28kPa) @ 25% compression
   h. Moisture Resistance: Absorption of less than 0.05% by volume when tested in accordance with ASTM C1104
   i. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   j. Fungi resistance: Zero mold growth to ASTM C1338
   k. Linear Shrinkage at 1200ºF (650ºC): Average linear shrinkage in all dimensions not to exceed 1% when tested to ASTM C356 at 1200ºF (650ºC).
   l. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   m. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.

3. Product: ROCKWOOL ROCKBOARD 80, non-combustible, rigid, multi-purpose mineral wool insulation board, water repellent.
   a. R-value: 4.0 /inch at 75ºF.
   b. Facing: Unfaced
   c. Melting Point – Minimum melting point temperature of 1177ºC (2150ºF).
   d. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0

e. Complies with ASTM C612 Type IVB
f. Density: 8.0 lbs/ft³ (128 kg/m³), actual.
g. Compressive Strength: 439 lbs./ft^2 (21kPa) @ 10% compression; 1065 lbs./ft^2 (50kPa) @ 25% compression
h. Moisture Resistance: Absorption of less than 0.05% by volume when tested in accordance with ASTM C1104
i. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
j. Fungi resistance: Zero mold growth to ASTM C1338
k. Linear Shrinkage at 1200°F (650°C): Average linear shrinkage in all dimensions not to exceed 1% when tested to ASTM C356 at 1200°F (650°C).
l. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
m. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.

D. Below-Grade and Basement Applications:
1. Product: ROCKWOOL Comfortboard 80, rigid exterior non-structural mineral wool insulation sheathing board that is non-combustible, water-repellent, fire-resistant and sound absorbent and provides a continuous layer of insulation around the commercial or residential building envelope.
a. R-value: 4.2 /inch at 75°F.
b. Facing: Unfaced.
c. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
d. Surface Burning Characteristics: Tested in accordance with ASTM E84
1) Unfaced: Flame Spread 0 and Smoke Developed 0
e. Density: 8.0 lbs/ft³ (128 kg/m³), actual.
f. Compressive Strength: 439 lbs./ft^2 (21kPa) @ 10% compression; 1065 lbs./ft^2 (50kPa) @ 25% compression
g. Moisture Resistance: Absorption of less than 0.05% by volume when tested in accordance with ASTM C1104
h. Vapor Permeability: 31 perm when tested in accordance with ASTM E96.
i. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
j. Fungi resistance: Zero mold growth to ASTM C1338
k. Linear Shrinkage at 1200°F (650°C): Average linear shrinkage in all dimensions not to exceed 0.7% when tested to ASTM C356 at 1200°F (650°C).
l. Listed with California Office of the State Fire Marshal (Cal Fire) Building Material Listing Service
m. Breaking Load and Flexural Strength (Thickness: 2”): Minimum 200 kPa when tested to ASTM C203.
n. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
o. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
p. DECLARE Certified

E. Acoustical Insulation for Fire Rated Interior Partition Walls and Ceilings (can be incorporated in Section 09 21 16): Unfaced.

1. Product: ROCKWOOL Acoustical Fire Batts (AFB); unfaced.
   a. Density: >2.5 lbs/ft³ (>40 kg/m³), nominal.
   b. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   c. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   d. Non-combustible: classified non-combustible per CAN/ULC S114
   e. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   f. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
   g. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   h. Fungi resistance: Zero mold growth to ASTM C1338
   i. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   j. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   k. Air Erosion: maximum air velocity of 1,000 fpm (5.08 m/s) per UL 181
   l. UL Classification Code: BZJZ
   m. ULC Classification Code: BZJZC
   n. GREENGUARD Gold Certified
   o. MEA Approval, New York City Approval – 338-97-M
   p. City of Los Angeles Approval – RR 25444

2. Product: ROCKWOOL Acoustical Fire Batts (AFB) for Wood Studs; unfaced.
   a. Density: >2.5 lbs/ft³ (>40 kg/m³), nominal.
   b. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   c. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   d. Non-combustible: classified non-combustible per CAN/ULC S114
   e. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   f. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
   g. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   h. Fungi resistance: Zero mold growth to ASTM C1338
   i. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   j. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   k. Air Erosion: maximum air velocity of 1,000 fpm (5.08 m/s) per UL 181
   l. GREENGUARD Gold Certified
   m. MEA Approval, New York City Approval – 338-97-M
   n. City of Los Angeles Approval – RR 25444

3. Product: ROCKWOOL Acoustical Fire Batts evo (AFB evo Formaldehyde Free); unfaced

a. Density (nominal): >2.2 lbs/ft³ (>38 kg/m³)
   1) Less than 3", density 2.5 lbs/ft³ (40 kg/m³).
   2) Greater than 3", density 2.2 lbs/ft³ (38 kg/m³).
b. Melting Point – Minimum melting point temperature of 1177ºC (2150ºF).
c. Surface Burning Characteristics: Tested in accordance with ASTM E84
   1) Unfaced: Flame Spread 0 and Smoke Developed 0
d. Non-combustible: classified non-combustible per CAN/ULC S114
e. Non-combustible: classified non-combustible per ASTM E136 at 750ºC
f. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
g. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
h. Fungi resistance: Zero mold growth to ASTM C1338
i. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
j. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
k. Formaldehyde Free (FF) - certified by UL Environment (ULE) Claim Validation
l. UL Classification Code: BZJZ
m. ULC Classification Code: BZJZC
n. GREENGUARD Gold Certified
o. DECLARE Certified
p. ULE Validated Formaldehyde Free

2.3 PERIMETER FIRE CONTAINMENT SYSTEMS

A. General: Provide where indicated for gaps between the perimeter edge of fire-resistance-rated floor assemblies and non-fire-resistance-rated exterior curtain walls.

1. Provide a perimeter fire-containment system with the fire test response characteristics indicated, as determined by testing identical systems per the Underwriters Laboratories or Intertek (OPL) Laboratories, or another testing and inspecting agency accountable to authorities having jurisdiction.

2. If no tested system exists, an engineering judgment provided by the manufacturer, 3rd party testing lab, or fire protection engineering firm that follows guidelines established by the International Firestop Council must accompany the design.

3. For non-fire resistance rated floor assemblies add an approved material or assembly for retarding the passage of flame and hot gasses.

B. Curtain Wall Insulation:

1. Product: ROCKWOOL CURTAINROCK 80 Insulation, rigid mineral wool insulation board designed for fire rated curtain wall applications.
   a. Minimum Thickness and Density as noted in tested and listed design.
   b. Density: 8.0 lbs/ft³ (128 kg/m³), nominal.
   c. R-value: 4.3 /inch at 75ºF.

d. Facing: Unfaced
e. Facing: Foil Faced
f. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
g. Surface Burning Characteristics: Tested in accordance with ASTM E84
    1) Unfaced: Flame Spread 0 and Smoke Developed 0
    2) Faced: Flame Spread 25 and Smoke Developed 10
h. Non-combustible: classified non-combustible per CAN/ULC S114
i. Non-combustible: classified non-combustible per ASTM E136 at 750°C
j. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.
k. Moisture Resistance: Absorption of less than 0.05 percent by volume, when tested in accordance with ASTM C1104.
l. Linear Shrinkage at 1200°F (650°C): Average linear shrinkage in all dimensions not to exceed 1% when tested to ASTM C356 at 1200°F (650°C).
m. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
n. Fungi resistance: Zero mold growth to ASTM C1338
o. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
p. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
q. UL Classification Code: XHGU
r. DECLARE Certified
s. INTERTEK Certified

2. Product: ROCKWOOL CURTAINROCK 40 Insulation, semi-rigid mineral wool insulation board designed for fire rated curtain wall applications.
    a. Minimum Thickness and Density as noted in tested and listed design.
    b. Density: 4.0 lbs/ft³ (64 kg/m³), nominal.
    c. R-value: 4.3 /inch at 75°F.
    d. Facing: Unfaced
    e. Facing: Foil Faced
    f. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
    g. Surface Burning Characteristics: Tested in accordance with ASTM E84
        1) Unfaced: Flame Spread 0 and Smoke Developed 0
        2) Faced: Flame Spread 25 and Smoke Developed 10
    h. Non-combustible: classified non-combustible per CAN/ULC S114
    i. Non-combustible: classified non-combustible per ASTM E136 at 750°C
    j. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.
    k. Moisture Resistance: Absorption of less than 0.05 percent by volume, when tested in accordance with ASTM C1104.
    l. Linear Shrinkage at 1200°F (650°C): Average linear shrinkage in all dimensions not to exceed 1% when tested to ASTM C356 at 1200°F (650°C).
    m. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
    n. Fungi resistance: Zero mold growth to ASTM C1338
    o. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.

p. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
q. UL Classification Code: XHGU
r. DECLARE Certified
s. INTERTEK Certified

3. Product: ROCKWOOL CURTAINROCK Insulation, semi-rigid mineral wool insulation board designed for fire rated curtain wall applications.
   a. Minimum Thickness and Density as noted in tested and listed design.
   b. Density: 3.5 lbs/ft³ (56 kg/m³), actual.
   c. R-value: 4.2 /inch at 75°F.
   d. Facing: Unfaced
   e. Facing: Foil Faced
   f. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   g. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
      2) Faced: Flame Spread 25 and Smoke Developed 10
   h. Non-combustible: classified non-combustible per CAN/ULC S114
   i. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   j. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.
   k. Moisture Resistance: Absorption of less than 0.05 percent by volume, when tested in accordance with ASTM C1104.
   l. Vapor Permeability: 32 perm when tested in accordance with ASTM E96.
   m. Linear Shrinkage at 1200°F (650°C): Average linear shrinkage in all dimensions not to exceed 2% when tested to ASTM C356 at 1200°F (650°C).
   n. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   o. Fungi resistance: Zero mold growth to ASTM C1338
   p. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   q. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   r. UL Classification Code: XHGU
   s. DECLARE Certified
   t. INTERTEK Certified

C. Safing Insulation:

1. Product: ROCKWOOL ROXUL Safe™ Insulation. Designated Type Safe in UL Fire Resistance Directory.
   a. Minimum Thickness and Density as noted in tested and listed design.
   b. Density: 4.0 lbs/ft³ (64 kg/m³), actual.
   c. Facing: Unfaced
   d. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   e. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   f. Non-combustible: classified non-combustible per CAN/ULC S114
   g. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   h. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.

i. Moisture Resistance: Absorption of less than 0.05 percent by volume, when tested in accordance with ASTM C1104.
j. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
k. Fungi resistance: Zero mold growth to ASTM C1338
l. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
m. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
n. UL Classification Code: XHJZC
o. DECLARE Certified
p. INTERTEK Certified

D. When ROXUL SAFE™ is used with CURTAINROCK®, CURTAINROCK® 40/80, it provides a comprehensive fire-stopping system that has been UL/ULC/Intertek tested and approved for perimeter fire containment systems, please contact manufacturer for specific listings.

2.4 FIRE RESISTIVE JOINT SYSTEMS IN RATED ASSEMBLIES / FIRESTOPPING OF THROUGH PENETRATIONS IN RATED ASSEMBLIES

A. Insulation for Joint Packing and Through Penetrations:

1. Product: ROCKWOOL ROXUL Safe™ Insulation. Designated Type Safe in UL Fire Resistance Directory.
   a. Minimum Thickness and Density as noted in tested and listed design.
   b. Density: 4.0 lbs/ft³ (64 kg/m³), actual.
   c. Facing: Unfaced
   d. Melting Point – Minimum melting point temperature of 1177°C (2150°F).
   e. Surface Burning Characteristics: Tested in accordance with ASTM E84
      1) Unfaced: Flame Spread 0 and Smoke Developed 0
   f. Non-combustible: classified non-combustible per CAN/ULC S114
   g. Non-combustible: classified non-combustible per ASTM E136 at 750°C
   h. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.
   i. Moisture Resistance: Absorption of less than 0.05 percent by volume, when tested in accordance with ASTM C1104.
   j. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
   k. Fungi resistance: Zero mold growth to ASTM C1338
   l. Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.
   m. Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025.
   n. UL Classification Code: XHJZC
   o. DECLARE Certified
   p. INTERTEK Certified

B. Smoke Barrier Sealant: Smoke sealant as listed in the appropriate fire tested assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this section will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

1. Install insulation in accordance with manufacturer's written recommendations and guidelines.
2. Install insulation to maintain continuity of thermal protection to building elements and spaces.
3. Do not compress insulation to fit into spaces.
4. Co-ordinate installation of firestopping insulation with Section [07 84 00 - Firestopping].
5. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
6. Keep insulation minimum 3" from heat emitting devices such as recessed light fixtures, and minimum 2" from sidewalls of chimneys and vents.

3.3 PROTECTION

A. Store the material to protect against weathering and physical damage, including humidity. Unpack the material at the installation site. Open a door or open a window to ensure good ventilation during installation on the construction site. Cover open ventilation ducts to reduce particulate in the ducts.

END OF SECTION

SECTION 072113 - RIGID PHENOLIC INSULATION

PART 1 **GENERAL**

1.1 SECTION INCLUDES

A. Rigid thermoset phenolic insulation board of the following types:
   1. Cavity board.
   2. Soffit board.
   3. Rainscreen board.
   4. EIFS board.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete Cast-In-Place Concrete; requirement that backup concrete be free of fins, protrusions and large holes.

B. Section 04 20 00 - Unit Masonry Masonry Units; requirement that backup masonry joints are flush and completely filled with mortar, and that excess mortar on brick ties will be removed; requirement for gap at deflection joints and fillers; coordination with sequencing of through-wall flashing.

C. Section 04 21 13 - Brick Masonry Insulated Concrete Unit Masonry; for insulation installed in cavity walls and on the interior of concrete block and monolithic walls.

D. Section 06 16 36 - Wood Panel Product Sheathing Insulating Sheathing; for insulation board installed over Steel or Wood framing members.

E. Section 07 10 00 - Dampproofing and Waterproofing Damproofing and Waterproofing; for insulation installed over waterproofing membrane materials, such as Self-Adhering Sheet Waterproofing, Elastomeric Sheet Waterproofing, Thermoplastic Sheet Waterproofing, Hot Fluid-Applied Rubberized Asphalt Waterproofing, Cold Fluid-Applied Waterproof-mg.

F. Section 07 26 23 - Below-Grade Gas Retarders Vapor Retarder; requirement that vapor retarder materials are installed in accordance with industry standards.

G. Section 07 26 23 - Below-Grade Gas Retarders Mechanically-fastened, Membrane Air Barriers; requirement that membrane air barriers are installed in accordance with industry standards.

H. Section 07 27 23 - Board Product Air Barriers Board Product Air Barriers; for insulation installed as the primary air barrier in an exterior wall assembly.

I. Section 07 28 00 - Underlayments* Water-resistive Barriers; requirement that water-resistive barrier materials are installed in accordance with industry standards.

J. Section 07 40 00 - Roofing and Siding Panels Wall Panels; for insulation installed behind various types of exterior wall panels, such as metal, wood, plastic, composite wall panels and fabricated wall panels.

K. Section 07 46 16 - Aluminum Siding Siding; for insulation installed behind various types of siding materials, such as cement-fiber, vinyl and wood.

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board.
2. ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions.
3. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
4. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
5. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
6. ASTM D6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
8. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
9. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.

B. Code Compliance Research Report: CCRR-1066 issued by Intertek.

C. UL Certification: FWFO - Exterior Wall Systems.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Submit insulation manufacturer's product data, Code Compliant Research Report and test reports along with the insulation manufacturer's printed installation guidelines.
1. Submit product literature or a letter from the insulation manufacturer indicating approval of products not manufactured by the specified insulation manufacturer.
2. If a letter is submitted, it shall include a statement that materials are compatible with adjacent materials proposed for use.

C. Samples: Submit clearly labeled samples, 5 inches by 7 inches (127 mm by 177.8 mm) minimum size of each material specified.

D. Shop Drawings of Wall Assembly Mock-Up: Submit shop drawings of proposed wall assembly mock-ups showing the location of the insulation board in the wall assembly and location of all wall window and door openings, penetrations and terminations involving structures attached to the exterior wall, i.e., decks, shelf angles, roof-wall intersections, etc.

1.5 QUALITY ASSURANCE

A. Insulation Manufacturer: Obtain insulation board from a single manufacturer regularly engaged in manufacturing phenolic insulation board of type specified. Obtain secondary materials from a source acceptable to the primary insulation manufacturer.

B. Accredited Laboratory Testing for phenolic insulation board: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).

C. Product shall have a current Code Compliant Research Report from a testing agency certifying physical properties, surface-burning characteristics, thermal resistance and attic /crawl space installation code compliant with 2015 and 2012 International Code Building (IBC), 2015 and 2012 International Residential Code (IRC) and 2015 and 2012 International Energy Conservation Code (IECC).

D. Installer qualifications:
1. Installer shall have experience with installation of water-resistive barriers, air barrier materials and insulation board. Installation shall be in accordance with insulation

manufacturer's installation guidelines.

2. Minimum 2 year experience installing similar products.

E. Wall Assembly Mock-Up: Build a mock-up representative of primary exterior wall assemblies using all specified insulation and other related auxiliary materials following the insulation manufacturer's installation guidelines. Mock-up shall be minimum 150 square feet in area and include all components in the exterior wall assembly.

1.6 PRE-INSTALLATION MEETINGS

A. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing work of this Section. Agenda shall include, at a minimum, review of wall assembly mock-up drawings, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation board to the project site in original packaging, labeled with manufacturer's information, product name, and date of manufacture, and instructions for storage.

B. Store insulation board in its original undamaged packaging or in a clean, dry, protected location and within temperature range required by insulation manufacturer. Protect stored materials from direct sunlight.

C. Handling: Handle materials to avoid damage.

1.8 PROJECT CONDITIONS

A. Temperature: Install insulation board within range of ambient and substrate temperatures recommended by the insulation manufacturer. Do not apply insulation board to a damp or wet substrate.

B. Field Conditions: Do not install insulation board in snow, rain, fog, or mist. Do not install insulation board or auxiliary materials when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the insulation and auxiliary material manufacturers.

1.9 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

B. Review requirements for sequencing of installation of the insulation board with installation of windows, doors, louvers and flashing materials to ensure a weather-tight air barrier assembly.

C. Schedule installation of exterior cladding within one month of installation of the insulation board.

1.10 WARRANTY

A. Material Warranty: Provide insulation manufacturer's warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Kingspan Insulation LLC, which is located at: 2100 RiverEdge Pkwy. Suite 175; Atlanta, GA 30328; Toll Free Tel: 800-241-4402; Tel: 678-589-7300; Fax: 678-589-7325; Email:request info (info@kingspaninsulation.us); Web:www.trustgreenguard.com

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. The phenolic foam core shall comply with ASTM C1126.
   1. Compressive Strength, Minimum (psi) ASTM D 1621: 21.
   2. Water Absorption, Maximum (% by volume) ASTM C 209: 1.0.
   3. Density, Minimum (lb/ft3) ASTM D 1622: 2.0.
   4. Closed Cell Content (% of cells closed) ASTM D 6226: 94.67.
   5. Air Permeance (L/S/m2) / (cfm/ft2) ASTM E 2178: 0.001 / 0.000.
   6. Water Vapor Permeance, Maximum 2 (perm) ASTM E 96: 0.48.

B. Phenolic insulation shall be manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

C. Insulation boards shall have a flame spread index of 25 or less and a smoke developed index of 20 or less unless noted otherwise.

D. Insulation boards may be used as an above grade exterior insulation.

2.3 RIGID THERMOSET PHENOLIC RAINSCREEN BOARD

A. Product: Kooltherm **K15** Rainscreen Board as manufactured by Kingspan Insulation LLC.
   1. Construction: Fiber- free rigid thermoset phenolic insulation core faced on both sides with a low emissivity composite foil facing.
   2. Application: Rigid thermoset insulation for rain screen cladding systems.
   3. Thermal: R-value of 16 on 2 inches (51 mm).
   4. Rating: ASTM E 84 rating of 25 / 20 (flame / smoke).

2.4 AUXILIARY MATERIALS

A. Tape: Kingspan GreenGuard Standard Seam Tape and / or Custom Seam Tape.

B. Tape: Kingspan self- adhesive reinforced aluminum foil tape.

C. Flashing: Kingspan GreenGuard Butyl Flashing and / or Kingspan GreenGuard SuperStetch Butyl Flashing.

D. Adhesives, Sealants and Primers: Adhesives, sealants and primers shall be compatible with the insulation board. Adhesives, sealants and primers referenced in the Kingspan Insulation LLC TB-011 and other products approved by the insulation manufacturer shall be acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which the insulation board will be applied, with installer present, for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing work of this Section. Do not proceed with installation until

unsatisfactory conditions have been corrected.

B. Review requirements for sequencing of installation of all wall assembly components as demonstrated in the mock-up wall assembly.

3.2 INSTALLATION - GENERAL

A. Insulation boards shall be installed in accordance with the manufacturer's published installation instructions, the applicable Code, and the Research Report. The manufacturer's published installation instructions and the Research Report shall be strictly adhered to, and a copy of the instructions shall be available on the jobsite during installation.

B. Insulation boards shall be separated from the interior of the building by a thermal barrier complying with IBC Section 2603.4 or IRC Section R316.4 as applicable.

3.3 INSTALLATION - CONCRETE SOFFIT INSULATION

A. Insulation boards shall be installed break- bonded, with joints lightly butted.

B. The number of mechanical fasteners required to fasten soffit board shall be determined by the geographical location of the building, the local topography, the height and width of the soffit substrate, and the soffit construction.

C. A minimum of 11 mechanical fasteners, with a minimum head diameter of 1-3/8 inches (35 mm) shall be required to secure the insulation board to the soffit. The fasteners shall be evenly distributed over the whole area of the board, and shall penetrate a minimum 1-1/2 inches (38 mm) into a solid substrate. Fasteners at board edges shall be located greater than 2 inches (51 mm) and less than 6 inches (152 mm) from edges and corners of the board and not overlap board joints.

3.4 INSTALLATION - ATTIC AND CRAWL SPACE INSULATION

A. Insulation Boards installed with glass fiber tissue facing the interior of the attic or crawl space may be used for walls and ceilings of attic or crawl spaces without an ignition barrier required by IBC Section 2603.4.1.6, or IRC Sections R316.5.3 or R316.5.4, when all of the following conditions are met:
   1. Entry to the attic or crawl space shall be only to service utilities and no storage is permitted. Utilities include, but are not limited to, mechanical equipment, electrical wiring, fans, and gas or electric hot water heaters and furnaces.
   2. There shall be no interconnected attic or basement areas.
   3. Air in the attic or crawl space shall not circulated to other parts of the building.
   4. Attic ventilation shall be provided when required by IBC Section 1203.2 or IRC Section R806, as applicable.
   5. Under-floor (crawl space) ventilation is provided that complies with IBC Sections 1203.3 or IRC Section R408.1, as applicable.
   6. Combustion air shall be provided in accordance with IMC (International Mechanical Code) Section 701.
   7. The insulation is limited to a maximum thickness of 4-3/4 inches (120 mm).

3.5 INSTALLATION - CAVITY WALL INSULATION

A. Install insulation board against the masonry wall using an adhesive or by friction fitting boards between masonry wall ties. When an adhesive is used, apply the adhesive using the amount and pattern recommended by the adhesive manufacturer.

B. Adjacent insulation board seams shall be staggered and all board edges shall be firmly butted together.

C. Install the exterior veneer in accordance with the manufacturer's installation instructions.

3.6 INSTALLATION - FRAMED WALLS - EXTERIOR INSULATING SHEATHING

A. Exterior walls shall be protected by a water-resistive barrier complying with IBC Section 1404.2 or IRC Section R703.2, and by wall coverings that provide the necessary structural wind and seismic resistance between the wall framing members.

B. Insulation boards shall not be used as a nailing base for siding materials. All fasteners shall penetrate through the insulation into the existing wall framing or structural sheathing as required by the wall covering manufacturer's instructions or the applicable Code.

C. Begin by aligning the first board at a corner of the structure making sure that the bottom of the board overlaps the sill plate.

D. Attach the insulation board using fasteners that are appropriate for the framing type.

E. Seal all gaps, penetrations and repair damaged areas by using a silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, or expanding spray foam complying with AAMA 812, or either Kingspan GreenGuard Seam Tape or Kingspan GreenGuard Butyl Flashing.

F. Install the exterior siding or cladding in accordance with the manufacturer's installation instructions. Refer to Table R703.4 of the International Residential Code (IRC) for attachment requirements for siding materials.

3.7 FIELD QUALITY CONTROL

A. Owner's Inspection and Testing: Cooperate with Owner's testing agency. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this section until testing and inspection is accepted.

3.8 PROTECTING AND CLEANING

A. Protect insulation board from damage during installation and remainder of construction period, according to manufacturer's written instructions.
   1. Coordinate with installation of insulation board to ensure exposure periods do not exceed the manufacturer's recommendations.

END OF SECTION

SECTION 072123 – LOOSE FILL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Loose-Fill insulation is used as nonstructural thermal insulating material in buildings of all types of construction. The insulation is for use on or within floors, floor-ceiling or roof-ceiling assemblies, attics, crawl space, ceilings, walls, and partitions, although not all

1.02 REFERENCE

A. American Society for Testing and Materials (ASTM).

1. E 84-10 Standard Test Method for Surface Burning Characteristics of Building Materials.
2. C 518-10 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

3. C 739-08 Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.

4. E 970-10 Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

5. C 1149-08 Standard Specification for Self-Supported Spray Applied Cellulosic Thermal Insulation.

6. E 136-09b Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

7. C 1015-06 Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation.

8. E 119-10a Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Consumer Products Safety Commission (CPSC) 16 CFR Part 1209, Interim Safety Standard for Cellulose Insulation, and 16 CFR Parts 500 and 1404 where applicable.

C. Federal Trade Commission (FTC) 16 CFR Part 460, Labeling and Advertising of Home Insulation.

D. Environmental Protection Agency (EPA) 40 CFR Part 247.12 Comprehensive Procurement Guideline For Products Containing Recovered Materials.
E. CAN / ULC S-703-09 Standard for Cellulose Fiber Insulation for Buildings.

F. CAN / ULC S-102.2-10 Standard Method Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous materials and assemblies.

G. Underwriters Laboratories (UL) Product Classification Marks are found on all bags. Page 2 of 4 WI-6.19-24 Rev D 07/13 H. State of California Section 1350 California Department of Public Health Standard Practice for VOC Testing

H. State of California Section 1350 California Department of Public Health Standard Practice for VOC Testing

1.03 Work Included: The work performed under this section shall include all materials, equipment, labor and services required to install insulation in accordance with these specifications and the manufacturer's installation instructions, and as indicated on the drawings if applicable.

1.04 Related Work: All electrical, plumbing, and mechanical penetrations must be completed prior to application. Air sealing, either fire-resistance rated or non-fire-resistance rated, must be completed where required as well. Certain exceptions may apply, for example, when using insulation as a fireblock in interstitial spaces between floors. Follow all Code and local jurisdiction requirements in the application of these products.

1.05 Submittals: Submit loose-fill insulation product literature, current Evaluation Report, and installation instructions for specified products and their application.

1.06 Delivery: A. Protect insulation from physical damage to the bag or the product itself, and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation. B. Insulation package labels include a production code that indicates date and place of manufacture, and all required current statutory and classification marks.

1.07 Limitations:

A. Avoid heating the work area with propane or kerosene space heaters. Use electric heaters and ventilation to avoid adding excessive moisture vapor to the building envelope.

B. Do not install insulation where it may be exposed to rain or ground water. Do not install loose-fill insulation in contact with masonry walls below grade. In any application where loose-fill insulation products may be exposed to high humidity, a detailed moisture control design must be used.

C. Do not allow loose-fill insulation to contact any surface above 194°F (90°C).

D. Keep insulation away from exhaust flues of furnaces, water heaters, space heaters, chimney flues or other heat or combustion producing devices. ASTM C 1015-06 recommends that a minimum of three inches of air space should be maintained between the insulation and heat source. Do not install loose-fill insulation products around heat or ignition

sources or operations such as welding, metal cutting, grinding or other potentially flammable situations.

E. Loose-fill insulation is not classified as noncombustible according to ASTM E 136-09b.

F. Loose-fill insulation products may not be used in thermal insulation applications where there is not an approved coverage chart on the bag. Some applications do not require the use of a thermal insulation coverage chart. Loose-fill insulation products can be used in

these applications provided manufacturer's installation instructions and all other applicable Code, fire safety and other requirements are met

Part 2 – Products

2.01 Manufacturer: US GreenFiber, LLC or Approved Equal

2.02 Materials: Loose-fill cellulose Insulation

A. Complies with 16 CFR Parts 460, 500, 1209 and 1404, ASTM C 1149-08, ASTM C 739-08, ASTM C 518-10, ASTM E 970-10, ASTM E 84-10, CAN / ULC S-102.2-10, CAN / ULC S-703-09 Type 1 and Type 2.

B. Surface Burning Characteristics

1. ASTM E 84-10: Flame spread <25, Smoke Developed Index <50

2. CAN / ULC S 102.2 Maximum Flame Spread 90

C. Complies with all building code requirements for cellulose fiber thermal insulation. Provide ICC ESR1996 or CCMC Listings 12911-L and 13162-L as required.

D. Complies with EPA 40 CFR Part 247.12.

E. Complies with Scientific Certification Services (SCS) certification report SCS-MC-02055 for minimum 85% recycled content, with minimum 55% post-consumer and 30% pre-consumer. The remaining 15% is fire retardant chemical and stabilizing additives.

F. No asbestos, mineral fibers, or formaldehyde are used in the manufacturing process.

G. Thermal Performance:

1. ASTM C 518-10, thermal performance varies with density and thickness. See the appropriate product coverage chart to calculate the R-value per inch if needed. All C 518-10 testing is done at a representative thickness of 4".

2. CAN / ULC S-703-09, varies depending on whether the product is Type 1 open or closed, or Type 2 open or closed.

Part 3 – Execution

3.01 Inspection:

A. Examine the areas and conditions under which work will be installed.

B. Verify adjacent materials are dry and ready to receive insulation.

C. Verify mechanical, plumbing and electrical services within walls have been inspected.

D. Provide a written report to the architect, builder or general contractor listing conditions that require correction prior to installation.

E. Do not proceed with installation until conditions as identified in 3.01-D have been corrected.

3.02 Preparation:

A. Remove any loose dust, dirt, foreign material or films that may impair adhesion to application surfaces.

B. Verify adhesion requirements and compatibility of all surfaces to receive thermal insulation materials.

C. Protect all nearby surfaces that are not intended to receive thermal insulation, e.g. outlets, windows and doors.

D. Make sure there are no assembly details that appear to be preventing the application of the product per the manufacturer's instructions.

3.03 Installation:

A. Read, understand and comply with manufacturer's instructions for particular conditions of installation.

B. Wear proper clothing and eye protection.

C. For breathing protection, use a NIOSH approved N95 or higher disposable or reusable particulate respirator per 29 CFR 1910.134.

D. The work shall be coordinated with other trades whose work may be affected by, or have an effect on, the installation.

E. Spray-applied insulation shall be installed with equipment specifically designed for its application.

F. Drying time varies due to local climate conditions including temperature, humidity and the installed moisture. Do not cover the insulation until the insulation moisture levels, measured and documented after minimum period of 24 hours from the time of installation, reach a moisture reading of 25% or less in accordance with manufacturer's manual,

3.04 Clean-up:

A. Remove sprayed material from surfaces not specifically required to be insulated.

B. Broom-clean work areas affected by the work of this section.

3.05 Documentation:

A. The installer must provide a completed form with the installed thickness and R-value claims or other documentation of the installation quality and performance, per 16 CFR Part

460. The installer must also apply attic rulers where appropriate per Code and FTC requirements.

B. When installing Spray-applied loose-fill Insulation, record the data on a quality control moisture measurement control log.

C. When installing stabilized Insulation for attics, record the data on a quality control moisture measurement control log.

SECTION 072701 - AIR AND VAPOR CONTROL LAYER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. INTERIOR AIR AND VAPOR CONTROL LAYER, including surface preparation.

1.2 RELATED SECTIONS

A. Section 07200 – Thermal Protection.
B. Section 07270 – Weather Resistive wind tight layer (membrane)
C. Section 07272 – Airtight tapes
D. Section 07500 – Membrane Roofing.

1.3 REFERENCES

A. ISO 9972:2006 / EN 13829 -– Determination of air permeability of buildings, Fan pressurization method
B. ASTM E779 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
C. ASTM E84 - Standard test method for surface burning characteristics of of building materials.
D. ASTM E2178 - Standard Test method for. Air Permeance of Building Materials
E. AATCC 127 – Hydrostatic pressure test
F. ISO 12572 - Hygrothermal performance of building materials and products
G. EN 1849-2 - Flexible sheets for waterproofing - Determination of thickness and mass per unit area
H. EN 12114 - Thermal performance of buildings - Air permeability of building components and building elements
I. EN 12310-1 - Flexible sheets for waterproofing. Determination of resistance to tearing (nail shank)
J. EN 12311-2 - Flexible sheets for waterproofing. Determination of tensile properties.
I. EN 13859-1 - Flexible sheets for waterproofing - Underlays for discontinuous roofing/(sheathing)
J. EN 1296 - Flexible sheets for waterproofing - Method for artificial ageing by long term exposure to elevated temperature
K. EN 1931: Determination of water vapor transmission properties

1.4 SUBMITTALS

A. Submit under provisions of Section 01300 - Submittal Procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Installation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
C. Verification Samples: For each product specified, two samples.
   1. Membranes: minimum size 6”x8”

2. Tapes: minimum length 5”
3. Gaskets, adhesives, accessories: one each

1.5 QUALITY ASSURANCE

A. Performance target: required airtightness level for this project is three (3) air changes per hour.

B. Installer Qualifications: Comply with one of the following requirements:
   1. The (sub-)contractor installing the interior airtight layer shall have as minimum experience with at least two buildings that was independently tested below 3.0ACH.
   2. The (sub-)contractor has completed the “Make it tight” training with 475 High Performance Building Supply
   3. The (sub-)contractor will conduct blower door testing as needed to achieve required airtightness

C. Mock-Up: Provide a mock-up for evaluation of installation techniques and application workmanship.
   1. Prior to installation of airtight layer, mock up airtight layer as follows to verify details and to demonstrate connections to adjoining construction elements, and other termination conditions.
   2. Install mockup of airtight layer in location designated by Architect.
   3. Do not proceed with remaining work until workmanship and application technique are approved by Architect.
   4. Construct typical interior wall, 8 feet wide by 8 feet long, illustrating materials interface and connections (tape, adhesives, gaskets), incorporating specified options including but not limited to the following:
      a. junctions of walls, foundations, ceilings, floors and roof,
      b. corner conditions
      c. window and doorframe connections, and
      d. blow-in insulation seals/battens.

D. Do not cover (with sheetrock, blocking, mechanical equipment or other elements that would restrict access to the airtight membrane) any components of the mock up (installed airtight layer membrane or other airtight elements) until it has been inspected, blower door tested and approved.

1.6 PRECONSTRUCTION MEETING

A. Preconstruction Meeting: Convene a meeting with all subcontractors affected by the Work of this Section a minimum of one week prior to commencing work of this section. Agenda shall include materials, details of construction, compatibility of materials, sequencing of construction/installation of membranes, the airtightness goal and emphasize that the success during the blowerdoor test is dependent on the collaboration of all subcontractors.

B. Coordinate Work with other subcontractors (plumbers, electricians, carpenters, HVAC), operations and installation of finish materials to install correct-sized gaskets on pipes, ducts and cable when these elements pass through the interior airtight layer, and to avoid damage to installed materials. Before they commence work on site, provide each effected trade with sufficient gaskets.

C. After meeting, post the following warning in a prominent location at all building entrances and top of each stair – 1/2” letter height minimum for header, 1/4” for all other text

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials on pallets. in clean and dry areas, not exposed to direct sunlight and in accordance with manufacturer's instructions. Store adhesives and primers at temperatures at or above 40 degrees Fahrenheit (4 degrees Celsius) to facilitate handling.

C. Protect materials during handling and application to prevent damage, puncturing or contamination.

1.8 ENVIRONMENTAL CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) as per manufacturers recommendations. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Minimize exposure of airtight membranes to direct sunlight. Use blinds or covers over window openings to block direct sunlight to prevent UV damage to membranes, if membranes will not be covered by sheetrock within 2 weeks or use exterior grade products (INTELLO X or SOLITEX line)

C. Minimize exposure to water. If exposure is likely, expected or cannot be avoided, use exterior grade products (INTELLO X or SOLITEX Line).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Pro Clima/Moll bauökologische Produkte GmbH, 68723 Schwetzingen Germany.

Imported by 475 High Performance Building Supply

334 Douglass Street, Brooklyn NY,

Tel: 718-622-1600

Email; info@foursevenfive.com

Web: www.foursevenfive.com / www.foursevenfive.ca

B. Substitutions: Approved equal

2.2 AIRTIGHT LAYER SYSTEMS

A. INTELLO Plus

1. Description: Intelligent vapor retarder (Hydrosafe) made from polyethylene copolymer membrane with polypropylene reinforcement grid
2. Airbarrier/smart vapor retarder is protected with PP cover fleeces on top and bottom
3. Class A rated material per ASTM E84 (Flame spread: 0, SDI:35)
4. Airtight material per ASTM E2178: 0.00005cfm/sf
5. Appearance: Translucent white
6. Weight 0.36 oz/sf ±15 g/m² (110g/m2) EN1849-2
7. Thickness: 16 mils (0.4 mm ±0.1 mm) EN1849-2
8. Perm rating: 13.20 to 0.13 (Sd value from 0.25m to >25m) ISO 12572

9. Temperature exposure limits: -40 to 176 degrees F (-40 to 80C)
10. Tensile Strength (EN13859-1)
    a. 350 N/50 mm MC
    b. 290 N/50 mm DC
11. Elongation (EN13859-1)
    a. 15% (MC)
    b. 15% (DC)
12. Nail Tear Resistance: 240N/200N (MC/DC) (54lbf/45lbf) EN 13859-1
13. Permeability consistent after artificial age testing: Pass – DIN EN 1296/1931
14. Living Building Challenge Declare label – red list free

B. INTELLO X:
1. Description: High performance vapor variable (Hydrosafe) membrane and temporary WRB for commercial buildings. Made from Polyehylene-Copolymer protected with two robust PP fleeces
2. 3 layer material – includes two robust PP protection fleeces that protect smart vapor retarder. Suitable to use as temporary roof or WRB during construction.
3. Class A rated material per ASTM E84 (Flame spread: 0, SDI:105)
4. Airtight material per ASTM E2178: 0.00005cfm/sf
5. Appearance: White
6. Weight 0.5 oz/sf ± 0.2 oz/sf (150g/m2 ± 5g/m2) EN1849-2
7. Thickness: 18 mils ± 2mils (0.45 mm ±0.05 mm) EN1849-2
8. Perm rating: 13.20 to 0.13 (Sd value from 0.25m to >25m) ISO 12572
9. Temperature exposure limits: -40 to 176 degrees F (-40 to 80C)
10. Tensile Strength (EN13859-1)
    a. 250 N/50 mm MC
    b. 170 N/50 mm DC
11. Elongation (EN13859-1)
    a. 60% (MC)
    b. 60% (DC)
12. Nail Tear Resistance: 27/27 lbf 120N/120N (MC/DC) EN 13859-1
13. Permeability consistent after artificial age testing: Pass – DIN EN 1296/1931
12. Water column 8.2ft (2.5m) AATCC 127 – DIN EN 20811
12. UV and weather exposure: 2 months

C. DB+
1. Description: Intelligent paper based vapor retarder, recycled paper with PE and a bi-directional fiberglass reinforcement grid.
2. Appearance: light blue
3. Weight 0.6 oz/sf (190 ±10 g/m2) DIN EN 1849-2
4. Thickness: 9 mils (0.23 ±0.1mm) DIN EN 1849-2
5. Perm rating: 8.2 to 0.8 (Sd value from 0.4m to 4m) ISO 12572
6. Temperature exposure limit: up to 104 degrees F
7. Tensile Strength (EN13859-1)
    a. 550 N/50 mm MC
    b. 420 N/50 mm DC
8. Elongation (EN13859-1)
    a. 5% MC
    b. 5% DC
9. Tear Resistance: 70N/70N (MC/DC) EN13859-1

10. Permeability consistent after artificial age testing: Pass – DIN EN 1296/1931

D. Airtight interior tape: TESCON VANA:
   1. Solid Acrylic tape with PP carrying fleece
   2. Perm rate: 8 (sd-value 0.4m) DIN EN1931
   3. Adhesion (ASTM D3330): 4.45Lbs/lin.inch INTELLO, 3.34lbs/lin/inch OSB
   4. Artificial age test: 100 years (per DIN 4108-7)
   5. Living Building Challenge Declare label – red list free
   6. Free of VOCs

E. Airtight interior corner tape: TESCON Profil or TESCON Profect, Solid Acrylic tape with PP carrying fleece and split release paper: Living Building Challenge Declare label – red list free, free of VOCs

F. Airtight window tape: CONTEGA SOLIDO IQ(-D): vapor retarding window tape with multiple release papers for specific or blind taped window airsealing.

H. Airtight adhesive: CONTEGA HF (contains VOC's/bio-ethanol) or CONTEGA Classic (VOC free), CONTEGA MULTIBOND (pre-cure adhesive on roll): non-embrittling adhesives for membrane connections to concrete, plywood floors and very rough/split wood.

2.3 ACCESSORIES

A. PRESSFIX tape pressurization tool.

B. Primer: TESCON Primer RP (for brick or concrete):
   1. Acrylic-copolymer based primer
   2. Application Temperature: Above 15 degrees Fahrenheit (-10 degrees Celsius)
   3. VOC free

C. Pipe, duct, cable sealing: ROFLEX and KAFLEX gaskets
   1. EPDM gaskets per specific pipe sizes
   2. Tape with TESCON VANA to airtight layer

D. Outlet sealing (recessed): LESSCO boxes
   1. Self sealing airtight outlet box
   2. Tape with TESCON VANA to airtight layer

D. Metal studs: cap screws

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates/surfaces have been properly prepared and cleaned from dust, silicones, oils and grease. Before installation, verify substrate is free of splinters, nails or other objects that could puncture membranes.

B. If window or door opening preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

C. If there are unexpected pipes, ducts or wires in the installation area/airtight layer or these penetrations do not have ROFLEX/KAFLEX gaskets around them, notify architect of unsatisfactory preparation before proceeding.

D. If floor, walls or ledger boards have been built that interfere with the airtight layer and a drawn/planned pre-installed airtight membrane was not installed as per sequencing plan, notify architect of unsatisfactory preparation before proceeding.

E. If long term exposure to UV or liquid water is likely or can be expected – USE INTELLO X or SOLITEX membranes only.

F. Acceptance of Conditions: Beginning of installation constitutes acceptance of existing conditions.

3.2 PREPARATION

A. Clean and prepare surfaces to receive air/vapor barrier in accordance with manufacturer's installation guidelines.

B. All surfaces must be clean, smooth and dry and must be clean of oil, dust, and silicone.

C. Batt installation: install membrane immediately after batt insulation is installed in winter.

D. Properly ventilate space or use dehumidifier to prevent high humidity conditions after concrete pours, sheetrock compounding and tile work. Monitor humidity if needed to ensure it stays below 60% relative humidity.

3.3 APPLICATION

A. Apply airtight layer/vapor retarder in accordance with manufacturer's instructions.

B. Install membranes taut and without creases along the substrate.

C. Overlap subsequent courses of membrane. Use the printed lines on the membrane as a guide.

D. Mechanically fasten as per 475 installation manuals

E. Battens for service cavities for densepacking should be spaced less than 20” o.c. and be perpendicular to the direction of the structure behind. Or other means should be employed to mechanically fix the membrane sufficiently to the substructure to long term support the weight/force exerted by the insulation – please contact 475 for additional means and methods.

D. Tape all overlaps. Use a PRESSFIX tape pressurization tool to ensure there is sufficient back-pressure when applying the pressure sensitive Pro Clima tapes. Make sure that tape joints are not permanently under stress, i.e. are supported by a batten or by cross taping the taped joint with 12” long pieces of tape every 12”

E. Overlap the membrane a minimum of 2” over dissimilar airtight materials (concrete, plaster).

F. Use CONTEGA HF (for below 0F application) or CONTEGA classic (VOC free) or MULTIBOND to adhere membranes to concrete, brick, plaster or rough OSB. Leave some slack in the membrane to allow for expansion and contraction between these dissimilar materials. Prime substrates with TESCON Primer RP if necessary.

G. If taping to membrane to porous or unknown substrates, they should be free of oil, silicone and dust. Do an adhesion test when in doubt. Primer recommended for application to brick, concrete, wood fiber insulation board and certain OSB brands.

H. Cut membrane with a utility knife in detail around penetrations.

I. Seal membranes to windows, joist and beams with TESCON Profil or CONTEGA line of airtight window tapes. Follow application guides of specific tapes.

J. Seal all penetrations with gaskets (ROFLEX or KAFLEX) taped with TESCON VANA airtight tape to airtight layer. Air seal around pre-existing penetrations (pipes, ducts or cables) with TESCON VANA tape in step like fashion, avoiding creases in tape.

K. Apply blown in insulation directly after installing interior airtight membranes.

L. Inspect membrane before blowerdoor test and/or dense-packing insulation. Ensure:
   1. each overlap is taped and has been pressurized
   2. staples applied at appropriate intervals
   3. counter battens at recommended distances
   4. tears and punctures repaired with Pro Clima tape
   5. adhesives (CONTEGA HF or classic) have had 48 hours to set up before test.

3.4 TESTING

A. Do a blowerdoor test as soon as the airtight layer is completely installed. During the test search for any detectible leaks with hands, IR or smoke pencils.

B. Document any leaks, and repair with Pro Clima tapes, adhesives and accessories.

C. Repeat test until building complies with project airtightness (ACH50 or CFM/SF75) goal, but at a minimum better than 1.0ACH50 or 0.15CFM/SF75

D. Re-do blowerdoor test if more than 3 holes/penetrations are made following completion of blowerdoor test above, or at the request of the architect.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Repair tears, punctures or burns (e.g. from sweating copper pipe) and/or replace damaged products before covering materials. Re-do blowerdoor test if more than 3 holes are made or by request of architect.

C. To protect interior airtight layer/membranes, apply service cavity insulation and sheetrock as soon as possible, and not later than specified exposure limit of used materials. Use tarps or other means of blocking UV if exposure times will be exceeded to protect membranes.

3.6 FINAL TEST

A. Blowerdoor test the installed membrane/interior airtight layer when:
   1. All penetrations have been made and sealed.
   2. Sheetrock and other finishes on exterior walls have been installed.

B. Find and repair leaks.

C. Repeat testing and repairs until the project complies with the project airtightness goal.

END OF SECTION

SECTION 072774 - SHEET AIR & WATER RESISTIVE BARRIER

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes but is not limited to the following:

1. A self-adhered sheet and accessory products for use as an air and water resistive barrier in exterior walls and sloping roofs.

2. Provide all accessory components required for a complete installation, including transitions to maintain continuity of the air and water barrier to adjacent construction, including but not limited to the following:

    a. Connections of the walls to the roof air barrier.
    b. Connections of the walls to the foundations
    c. Seismic and expansion joints.
    d. Openings and penetrations of window frames, door frames, store front, curtain wall.
    e. Concrete and other envelope systems.
    f. Door frames piping, conduit, duct and similar penetrations.
    g. Masonry ties, screws, bolts and similar penetrations.
    h. All other air leakage pathways through the walls.

3. Engage a testing agency to perform specified field testing and inspections.

B. Related Sections include but are not limited to the following:

1. Division 7 Section “Flashing and Sheet Metal” for through-wall flashings. Through wall flashings shall be metal.

1.2 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Association of Textile Chemists and Colorists (AATCC) Test Method 127. “Water Resistance – Hydrostatic Pressure Test”.

B. American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE) Standard 90.1-2010 “Energy Standard for Buildings Except Low-Rise Residential Buildings”.

C. ASTM C 920 Standard Specification for Elastomeric Joint Sealants.

D. ASTM C 1305 Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane.

E. ASTM D 882 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.

F. ASTM D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

G. ASTM D 1876 Standard Test Method for Peel Resistance of Adhesive.

H. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modifed Bituminous Sheet Materials Used as Steep slope roofing Underlayment for Ice Dam Protection.

I. ASTM D 4073 Standard Test Method for Tensile-Tear Strength of Bituminuous Roofing Membranes.

J. ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

K. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

L. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.

M. ASTM E 783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

N. ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

O. ASTM E 1354 Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter.

P. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials.

Q. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

R. National Fire Protection Association (NFPA) 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.3 DEFINITIONS

A. Air and water resistive Barrier: The collection of vapor retarding air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control movement of air and water vapor through the wall.

1.4 SUBMITTALS

A. Product Data

Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier. Include curing requirements for all substrates and membrane materials. Include installation instructions for all materials. Installation instructions shall take into account the sequence of installation of adjacent construction materials.

B. Shop Drawings

1. Show locations and extent of air and water barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction. Details shall include all conditions and auxiliary materials required for the provision of an air and water barrier continuous with other elements of the building envelope, whether or not these are indicated explicitly on the contract Drawings.

2. Include details of interfaces with other materials that form part of air and water barrier. Include details of interfaces with other materials that form part of the water drainage plane, including metal through-wall flashing, termination bars, and sealants.

3. Details shall indicate conditions specific to the Project. Manufacturer’s typical details that do not reflect the actual Project conditions are insufficient. Details shall allow for proper sequence of installation of all components of the building envelope.

4. Include details of mockups.

C. Product Certificates

For air and water barriers, certify compatibility of air and water barrier and accessory materials with Project materials that connect to or that come in contact with the barrier.

Contacted materials shall include, but not be limited to, masonry, masonry reinforcement, concrete, steel members, insulation, copper/fabric flashing, stainless steel flashing, flashing termination bar, termination bar sealant, door and window frames.

D. Guarantee and Warranty

Submit Contractor’s Guarantee and manufacturer's Warranty.

E. Mock-up

Provide mock-up as indicated under Quality Assurance.

F. Qualification Data

1. For applicator/installer.

2. For membrane manufacturer.

3. For testing agency.

4. For Company Field Advisor

G. Test and Inspection Reports.

1. Product Test Reports: Comprehensive tests performed based on evaluation by an independent testing agency qualified for air barriers.

2. Field Test Reports.

a. Preconstruction – mockup.

b. Construction.

3. Field Inspection Reports.

H. Certifications

1. Air and water barrier manufacturer's Field Advisor's certification of completed Work as specified.

1.5 QUALITY ASSURANCE

A. Qualifications

2. Applicator Qualifications: A firm experienced in applying air barrier 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.

3. Membrane Manufacturer Qualifications: A company manufacturing air barrier materials of types indicated for this Project, that have resulted in applications with a record of successful in-service performance for a period of at least five years.

4. Testing Agency Qualifications: An NRTL, or an NVLAP, or an independent agency with a specialty in non- destructive testing and forensic investigation. Testing agency shall have experience conducting the indicated testing and inspection of air barrier systems, and shall be acceptable to the Authority.

a. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

b. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

B. Comply with applicable regulations regarding use and application of products that contain volatile organic compounds (VOC).

C. Company Field Advisor

Secure the services of a Company Field Advisor of the air and water barrier manufacturer. The Field Advisor shall be certified in writing by the manufacturer to be technically qualified in design, installation, and servicing of the required products. Personnel involved solely in sales do not qualify. The Field Advisor shall be present at the pre-installation conference, at construction of the mockup, at the beginning of the actual air barrier installation, and as necessary throughout the project for the purpose of:

1. Rendering technical assistance to the Contractor regarding installation procedures of the system.

2. Familiarizing the Authority's Representative with all aspects of the system.

3. Answering all questions which might arise.

The Field Advisor shall make periodic visits during the execution of the Work, and shall certify the Work upon completion.

D. Mockups

Before beginning installation of air and water barrier, build mockups of exterior wall assembly, at least 150 sq. ft. of each assembly type, incorporating backup wall construction, relieving angle, window or window receptor, door frame and sill, insulation, and flashing to demonstrate surface preparation, sequence of installation, crack and joint treatment, and sealing of gaps, terminations, transitions, and penetrations of air barrier membrane.

1. Coordinate construction of mockup to permit access for inspection by testing agency of air barrier

2. Include roof curb condition, building corner condition, window condition and foundation wall intersection.

3. If Authority’s representative determines that mockups do not comply with requirements, reconstruct mockups and apply air and water barrier until mockups are approved.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PERFORMANCE REQUIREMENTS

A. General: Air and water barrier shall perform as a continuous vapor-retarding air barrier and as a liquid- water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall accommodate substrate

movement and seal substrate and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits. Air barrier shall withstand positive and negative air pressure without damage or displacement. Air barrier shall pass preconstruction testing and field quality control testing and inspection as specified.

A. Installed product and accessories constitute a continuous air barrier, as described in ASHRAE Standard 90.1-2010 Section 5.4.3.1

B. Installed product and accessories shall perform as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration.

C. Installed product and accessories shall exhibit an air leakage rate, infiltration and exfiltration modes, measured after pressure cycling, not to exceed 0.2 L/s*m^2 at 75 Pa (0.040 CFM/ft^2 at 1.57 PSF) according to ASTM E 2357.

D. Installed product and accessories shall provide rater-measured compartmentalization no greater than 0.30 CFM50 per square foot of dwelling unit enclosure area (envelope) based on procedures in ANSI / RESNET / ICC Std. 380.

E. For Type I, II, III and IV construction: Installed product and accessories shall be evaluated to NFPA 285 in wall assemblies of Project.

F. Product shall consist of nominal 0.018 inch (18 mils) thickness composite membrane consisting of an engineered fabric laminated with a permeable pressure-sensitive adhesive.

G. Product shall meet the following requirements:

REQUIREMENT	RESULT	TEST METHOD
Air Permeance	Not more than 0.02 L/s*m^2 at 75 Pa (0.004 CFM/ft^2 at 1.57 PSF)	ASTM E-2178
Tensile Strength	Not less than 40 lbf per inch	ASTM D-882
Peel Adhesion	Not less than 5 lbf, per inch on glass mat faced gypsum sheathing with approved surface preparation	ASTM D 903
Tear Initiation and Propagation	Not less than 30 lbf, machine direction and cross direction	ASTM D 4073
Low Temperature Flexibility	No cracking at minus 20 degrees F, 1 inch mandrel	ASTM D 1970

Water Resistance	Membrane specimen including a lap shall resist a 55 cm (22 inch) column of water for 5 hours, no leaking or wet through.	AATCC-127, modified static head generated with 5"diameter PVC pipe sealed to specimen
Pull Adhesion	Not less than 16 lbf per square inch (or report value at substrate failure) on glass-faced gypsum sheathing and concrete masonry unit, substrate prepared with contact adhesive	ASTM D 4541, modified 4 inch puck
Lap Adhesion	Not less than 1 lbf per inch of width	ASTM D 1876
Water Vapor Permeance	Minimum 9 Perms	ASTM E-96, Method A
	Minimum 10 Perms	ASTM E-96, Method B
Surface Burning Characteristics.	Flame Spread Index: Not more than 25 Smoke Generation Index: Not more than 450	ASTM E 84, sample tested at full coverage, cement board substrate, including surface

REQUIREMENT	RESULT	TEST METHOD
		preparation
Measurement of Heat Release Rate by Cone Calorimeter	Effective Heat of Combustion of 17 MJ/kg or less Peak heat release rate of 183 kW/m^2 or less Total heat release rate of 6.1 MJ/m^2 or less	ASTM E 1354, membrane applied to glass-faced gypsum sheathing, including surface preparation. 50 kW/m^2 heat flux.

1.7 PRECONSTRUCTION TESTING

A. Mockup Testing: Air and water barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency acceptable to the Authority.

1. Qualitative Testing: Test mockups for evidence of air leakage according to ASTM E1186, at a test pressure differential not less than 1.57 lbf/sf.

B. Field-Constructed Mock-Ups: Prior to installation on Project, apply Product and Accessories on mock-up to verify details under shop drawing submittals, to demonstrate tie- ins with adjoining construction and other termination conditions and to become familiar with properties of materials in application:

1. Apply in field-constructed mockups of assemblies as specified below:

2. Construct typical exterior wall panel, minimum 150 square feet in area, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing, building corner condition, junction with roof system, foundation wall and typical penetrations and gaps; illustrating interface of materials and seals.

C. Test mock-up in accordance with ASTM E 783 and ASTM E1105 for air and water infiltration.

D. Cooperate and coordinate with the Authority's inspection and testing agency. Do not cover any installed Product unless it has been inspected, tested and approved.

E. Remove and replace deficient air barrier components, when air leakage or other deficiencies are detected, and retest as specified above.

F. Provide all equipment and materials required for testing.

G. Notify the Authority's representative 14 days in advance of the dates and times when mockup testing will take place.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, lot number and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by Manufacturer.

C. Avoid spillage. Immediately notify the Authority if spillage occurs and start clean up procedures. Clean spills and leave area as it was prior to spill.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.10 GUARANTEE AND WARRANTY

A. Contractor's Guarantee

Submit two-year written guarantee covering defects in materials and workmanship, including primary air barrier and auxiliary materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure properly. Time of guarantee shall commence with approval of the substantial completion payment for the Work, or the final payment for the work if no substantial completion payment is made. Should any defects develop during the period of guarantee, such defects shall at once be remedied without cost or expense to the Authority. Contractor shall be responsible for removal and replacement of Work of other Sections as required for access to the Work of this Section.

B. Manufacturer's Warranty

In addition to the Contractor's Guarantee submit manufacturer's two-year Warranty that air barrier and accessories are free of defects and are manufactured to meet manufacturer's published properties and the requirements of this Specification. Manufacturer shall promptly replace defective materials without cost or expense to the Authority.

PART 2 - PRODUCTS

2.1 FULLY-ADHERED SHEET AIR & WATER RESISTIVE BARRIER

A. Fully–adhered sheet air and water resistive barrier the manufacturers and systems listed below are acceptable subject to compliance with specified requirements.

1. Carlisle Coatings & Waterproofing, Inc.; “Fire Resist 705 VP”
2. Henry; Blueskin VP 160 self-adhered water resistive air barrier

B. Detail Flashing:

Standard, 60 membrane consisting of cross-laminated HDPE film coated with rubberized asphalt adhesive.

a. CCW: CCW-705 or approved equal.

2. UV Resistant, 180 day exposure allowed. 0.040 inch thickness (40 mil) membrane consisting of aluminum- faced cross-laminated HDPE film coated with rubberized asphalt adhesive.

a. CCW: Fire Resist 705 FR-A or approved equal.

3. Heat and UV Resistant, 180 day exposure allowed. Use over foam sheathing. 0.030 inch thickness (30 mil) mil membrane consisting of aluminum foil coated with non-asphalt butyl adhesive.

a. CCW: AlumaGRIP-701 or approved.

4. Liquid Flashing: Heat and UV resistant, 180 day exposure allowed. Nominal 0.040 inch (40 mil) thickness flexible polymer with imbedded reinforcement.

a. CCW: Fire-Resist Barritech NP with imbedded LiquiFiber- or approved equal.

C. Contact Adhesive: Liquid or spray-applied for preparing surfaces accepting air barrier membrane:

1. CCW:
   a. CCW-702 WB Water-Based or CAV-GRIP™ Aerosol Spray or approved equal.

B. Detail Mastic: 1-part material for sealing details. Installation over air barrier membrane.

1. CCW:
   a. Universal Single Ply Sealant for 180 day exposure system.
   b. LM 800 XL for 60 day exposure system.

C. Transition Membrane: Tough, elastomeric sheet capable of bridging a 1” gap.

1. CCW: SURE-SEAL Pressure-Sensitive Elastoform or approved equal.

D. Fill Compound: 2-part chemical cure sealant, compatible with adhesive side of air barrier membrane.

1. CCW: CCW-703 V Modified polyurethane, 2-part or CCW-201 Polyurethane, 2-part or approved equal.

2.2 AUXILIARY MATERIALS

A. Polyurethane Sealant: used for sealing membrane surface defects, penetrations and terminations:

1. Approved by CCW: Sonneborn NP-1, Dymonic FC, S-M 7100 Permathane Pro-Installer by Schnee-Morehead Div, ITW or Xtra-Bond 7500 TX by Premiere Industrial Supply or approved equal.

B. Silicone Sealant: used for sealing fenestration to air barrier membrane, surface defects and penetrations.

C.

1. Approved by CCW: Dow-Corning 758, 790, 791 or 795 or Pecora AVB Silicone, 890, 891 or 895 or GE Silpruf or Silpruf LM or approved equal.

D. Polyurethane Foam Sealant: used for sealing gaps around fenestration and other penetrations.

1. Approved by CCW: Great Stuff by Dow Chemical Company, FireBlock Gun Foam by TVM Building Products or Fireblock Foam Sealant by FOMO or approved equal.

E. Insulation Adhesive: used for bonding foam board insulation to air barrier membrane.

1. Approved by CCW for polyisocyanurate insulation: LM 800 XL or CAV-GRIP Spray Contact Adhesive by Carlisle Coatings & Waterproofing Incorporated or approved equal.

2. Approved by CCW for extruded polystyrene insulation: CAV- GRIP Spray Contact Adhesive by CCW, QB-300 Multi-Pupose Construction Adhesive by OSI or PL-300 VOC Foamboard Adhesive by Loctite or approved equal.

2.3 PRE-INSTALLATION CONFERENCE

A. Conduct a conference at the Project site prior to construction. Attendees are to include representatives of the Contractor, installer, Contractor's testing firm, the Designer of Record, and the Authority's Construction Inspection Division Inspector and Construction Manager.

1. Include installers of other construction connecting to air and water barrier, including but not limited to waterproofing, sealants, flashing, windows, door frames, and roofing as applicable.

2. Review air and water barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and flashings, mockups, installation procedures,

sequence of installation, testing and inspecting procedures, and protection and repairs.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine substrates, areas, and conditions affecting installation of the air and vapor barrier and accessory products for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing Work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wall assemblies are dried in, such that water intrusion will not occur from above, behind or around the air barrier installation.

D. Concrete shall be cured for a minimum of seven days. It shall be smooth, with sharp protrusions such as form joints ground flush. Honeycomb and holes/cracks exceeding ¼ inch across shall be filled with grout or mortar.

E. Surfaces shall be sound, dry and free of oil, grease, dirt, excess mortar or other contaminants.

F. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.

G. Mortar joints shall be struck flush and shall be free of voids exceeding ¼ inch across. Mortar droppings shall be removed from brick ties and all other surfaces accepting air barrier.

H. Rigid foam, plywood, OSB or gypsum exterior sheathing boards shall be flush at joints, with gaps between boards according to building code and sheathing manufacturer's requirements. Sheathing boards shall also be securely fastened to the structure with proper fastener type, technique and spacing according to building code and sheathing manufacturer's requirements. Sheathing boards shall be repaired or replaced if inspection reveals moisture damage, mechanical damage or if sheathing boards have exceeded the exposure duration or exposure conditions as required by the sheathing manufacturer.

I. Plywood, OSB, lumber or pressure-treated wood moisture content, measured with a wood moisture meter in the core of the substrate, shall be below 20%.

J. Inform the Authority in writing of

1. Cracks in concrete and masonry.

2. Gaps or obstructions such as steel beams, angles, plates and projections which cannot be spanned or covered by Product or Accessories.

3. Anticipated problems applying Product and Accessories over substrate.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust- free, and dry substrate for air barrier application.

1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane.
2. Fill all voids and holes greater than ¼ inch across at any point with mortar, sealant or other approved fill material.
3. Surface irregularities exceeding ¼ inch in height or sharp to touch shall be ground flush or made smooth.
4. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
5. If the surfaces cannot be made smooth to the satisfaction of the Architect, it will be the responsibility of the trade to alternatively apply a parge coat (typically one part cement to three parts sand) over the entire surface to receive Air Barrier Membrane.
6. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.

B. Fill cracks, gaps and joints exceeding ¼ inch width with fill compound or polyurethane sealant.

C. Fill rough gaps around pipe, conduit and similar penetrations with mortar, non-shrink grout, fill compound or polyurethane foam sealant shaved flush.

D. Apply a ¾ inch cant of fill compound at the intersection of the base of the wall and the footing.

E. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants, or film-forming coatings from concrete.

F. Remove fins, ridges, mortar, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching material recommended by air barrier manufacturer.

G. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.5 AIR AND WATER BARRIER MEMBRANE INSTALLATION

A. Apply product over opaque wall surfaces as indicated in Project drawings.

B. Allow sealants used during surface preparation to cure fully before applying product.

C. Apply contact adhesive to all surfaces accepting product, according to manufacturer's instructions.

D. Apply product to prepared surfaces according to manufacturer's instructions and drawings.

E. Sequence installation to provide shingled laps. Lap neighboring sheets 3 inches minimum.

F. Install detail flashing or transition membrane according to manufacturer's drawings and instructions at expansion joints, seismic joints, mechanical/electrical penetrations and similar conditions.

G. Install detail mastic, polyurethane sealant or silicone sealant covering non-water shedding laps, penetrations and similar surface defects.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Contractor is to engage a qualified testing agency, acceptable to the Authority, to perform tests and inspections and to prepare test reports and inspection reports for submission to the Authority. Where required by the 2016 NYC Energy Code, inspection shall utilize the Air Barrier Continuity Plan.

B. Inspections: Air and water barrier materials and installation shall be inspected for compliance with requirements. Inspections shall include the following:

1. Continuity of air barrier system has been achieved, with no gaps or holes. Inspect each type of unique air barrier joint.

2. Continuous structural support of air barrier system has been provided.
3. Site conditions for application temperature and dryness of substrates have been maintained.

4. Maximum exposure time of materials to UV deterioration has not been exceeded.

5. Transition surfaces have been prepared with adhesive primer.

6. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the moisture shedding direction (or mastic has been applied on exposed edges), with no fishmouths.

7. Termination mastic has been applied on cut edges.

8. Strips and transition strips have been firmly adhered to substrate.

9. Compatible materials have been used.

10. Transitions at changes in direction and structural support at gaps have been provided.

11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural

support, integrity, and continuity of seal. Seals allow for relative movement of different assemblies due to expansion, contraction and other building movement.

12. All penetrations, seams, joints, and openings have been sealed.

13. All transitions in plane and changes in substrate materials have been sealed.

14. Seals to flashing and termination bars have been provided.

15. All other specified requirements have been met.

C. Field Tests: Testing shall include:

1. Qualitative Testing: Air barrier assemblies shall be tested for evidence of air leakage according to ASTM E1186, at a test pressure differential not less than 1.57 lbf/sf.

a. Chamber depressurization using detection liquids (Bubble Gun): Test at seams and penetrations. Perform at least one test for each 9000 sq. ft. of wall area, and as directed by the Owner's representative. If leakage is detected, perform additional tests as directed by the Authority's representative.

1. If cladding system does not have discrete penetrations such as masonry ties, a smoke chamber test is to be utilized in lieu of the "Bubble gun" method. Size shall be sufficient to encompass seams and cladding support penetrations.

b. Smoke pencil with pressurization or depressurization: Perform testing at a minimum of two locations selected by the Owner's Representative. These tests are in addition to the mockup testing. Each test location area shall be at least 80 square feet. Each location shall include a window and brick ties. Perform the first test when masonry Work is 25% complete and the second test when masonry is 75% complete.

If leakage occurs at any location, repair and retest at that location and perform two additional tests at other locations selected by the Owner's Representative. For each subsequent failure where leakage is observed perform two additional tests.

Perform tests with window in place, or with window receptor in place and the window opening sealed off. Perform tests prior to installation of insulation and face brick in the test area.

4. Provide all equipment and materials required for testing. Repair all parts of the Work disrupted or damaged in the course of testing.

5. As per the 2016 NYC Energy Code, perform a full building air infiltration test in accordance with ASTM E779 and NYC Building Department Rules. Air permeability shall not greater than 0.40 cfm/ft^2 under a pressure differential of 0.3-inch water gage. Testing shall be in the presences of the Owner's inspection representative. Account for time required to perform test and include in project

schedule. Provide all equipment and sealing of building. Test will need to be done prior to installation of veneer and needs to integrate all fenestration.

D. Remove and replace deficient air barrier components, when air leakage or other deficiencies are detected, and re- inspect and retest as specified above.

3.7 JOB COMPLETION

A. A representative of the air barrier manufacturer (Company Field Advisor) shall inspect the Work periodically and notify the contractor of any defects. All defects must be corrected. The representative shall submit written certification to the Owner that representative has consulted on and inspected the work and that the materials and installation are in conformance with the manufacturer's published physical properties and installation recommendations and with the Contract Documents.

B. Cleaning and Protection

1. Protect air and water barrier system from damage during application and remainder of construction period. Comply with manufacturer's instructions.

   a. Protect air and water barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 days or longer than recommended by the manufacturer.

   b. Protect air and water barrier from contact with creosote, uncured coal-tar products, sealants not approved by air barrier manufacturer, and other non-compatible materials.

   c. Protect air and water barrier from mechanical damage.

2. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:	_____	_____
1. Air and water barrier Shop		
Drawings:	_____	_____
1. Air and water barrier Product		
Certificates:	_____	_____
1. Compatibility Contractor		
Guarantee:	_____	_____
1. Air and water barrier Manufacturer		
Warranty:	_____	_____
1. Air and water barrier		
Mockup	_____	_____
1. Air and water barrier Qualification		
Data	_____	_____
1. Installer 2. Manufacturer 3. Testing Agency 4. Company Field Advisor		
Test & Inspection Reports:	_____	_____
1. Product test reports 2. Field test reports- mockup 3. Field test report- construction 4. Field inspection reports Certifications		
5. Field Advisor certification of completed Work	_____	_____

* * *

SECTION 074113 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam metal roof panels.
2. Concealed-fastener, lap-seam metal roof panels.
3. Standing-seam metal roof panels.
4. Batten-seam metal roof panels.
5. Horizontal-seam (Bermuda-type) metal roof panels.
6. Foamed-insulation-core metal roof panels.
7. Metal soffit panels.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than [**0.06 cfm/sq. ft. (0.3 L/s per sq. m)**] <**Insert rate**> of roof area when tested according to ASTM E 1680 at the following test-pressure difference:

1. Test-Pressure Difference: Negative [**1.57 lbf/sq. ft. (75 Pa)**] <**Insert pressure**>.
2. Test-Pressure Difference: Positive and negative [**1.57 lbf/sq. ft. (75 Pa)**] <**Insert pressure**>.

3. Positive Preload Test-Pressure Difference: [**Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference**] <**Insert pressure**>.
4. Negative Preload Test-Pressure Difference: [**50 percent of design wind-uplift-pressure difference**] <**Insert pressure**>.

D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure Difference: [**2.86 lbf/sq. ft. (137 Pa)**] <**Insert pressure**>.
2. Test-Pressure Difference: [**20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12.0 lbf/sq. ft. (575 Pa)**] <**Insert pressure**>.
3. Positive Preload Test-Pressure Difference: [**Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference**] <**Insert pressure**>.
4. Negative Preload Test-Pressure Difference: [**50 percent of design wind-uplift-pressure difference**] <**Insert pressure**>.

E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: [**UL 30**] [**UL 60**] [**UL 90**].

G. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: [**Class 1A-60**] [**Class 1A-75**] [**Class 1A-90**] [**Class 1A-105**] [**Class 1A-120**] <**Insert number**>.
2. Hail Resistance: [**MH**] [**SH**].

H. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

   a. Uniform pressure of [**20 lbf/sq. ft. (957 Pa)**] [**30 lbf/sq. ft. (1436 Pa)**] <**Insert design wind pressure**>, acting inward or outward.
   b. Uniform pressure as indicated on Drawings.

2. Snow Loads: [**25 lbf/sq. ft. (1197 Pa)**] [**30 lbf/sq. ft. (1436 Pa)**] [**35 lbf/sq. ft. (1676 Pa)**] <**Insert load**>.

3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than [**1/180**] [**1/240**] of the span.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): [**120 deg F (67 deg C), ambient; 180 deg F (100 deg C)**] <**Insert temperature range**>, material surfaces.

J. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

K. Solar Reflectance: Initial solar reflectance of not less than [**0.65**] [**0.70**] when tested according to ASTM E 903, and maintained, under normal conditions, solar reflectance of not less than 0.50 for 3 years after installation.

L. Solar Reflectance: Initial solar reflectance of not less than 0.25 when tested according to ASTM E 903, and maintained, under normal conditions, solar reflectance not less than 0.15 for 3 years after installation.

M. Minimum Emissivity Rating: Provide roofing materials with [**0.75**] [**0.90**] or greater emissivity when tested according to ASTM E 408.

1.5 SUBMITTALS

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

Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

a. Flashing and trim.
b. Gutters.
c. Downspouts.
d. Roof curbs.
e. Snow guards.

B. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal [**Roof**] [**and**] [**Soffit**] Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, [**clips,**] [**battens,**] closures, and other metal roof panel accessories.
2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.

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

1. Snow Retention System Calculations: Include calculation of number and location of snow guards based on snow load, roof slope, panel length and finish, and seam type and spacing.

E. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof panels and attachments.
2. Purlins and rafters.
3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.

F. Qualification Data: For qualified [**Installer**] [**professional engineer**] [**and**] [**testing agency**].

G. Material Certificates: For [**thermal insulation**] [**and**] [**vapor retarders**], from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

I. Field quality-control reports.

J. Maintenance Data: For metal roof panels to include in maintenance manuals.

K. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

D. Surface-Burning Characteristics: Provide metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: [**25**] <**Insert value**> or less.
2. Smoke-Developed Index: [**450**] <**Insert value**> or less.

E. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Combustion Characteristics: ASTM E 136.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave[**, including fascia,**] [**and soffit**] as shown on Drawings; approximately [**four panels wide**] <**Insert size**> by full eave width, including insulation,[**underlayment,**] attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, [**deck**] [**purlin and rafter**] Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
4. Examine [**deck substrate**] [**purlin and rafter**] conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of [**deck**] [**purlins and rafters**] during and after roofing.
6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for metal roof panel assembly during and after installation.
9. Review roof observation and repair procedures after metal roof panel installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

E. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of [**decks,**] [**purlins and rafters,**] parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

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

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. <**Insert failure modes**>.

2. Warranty Period: [**Two**] <**Insert number**> years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: [**10**] [**20**] <**Insert number**> years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Weathertight Warranty Period: [**Five**] [**10**] <**Insert number**> years from date of Substantial Completion.

D. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: [**20**] <**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
3. Surface: [**Smooth, flat**] [**Embossed**] finish.
4. Exposed Coil-Coated Finish:

   a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   b. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   c. 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   d. Mica Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   e. Metallic Fluoropolymer: AAMA 621. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   f. FEVE Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   g. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
   h. Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.

5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: [**Smooth, flat**] [**Embossed**] finish.
2. Exposed Coil-Coated Finish:

a. 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. 4-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
d. Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
e. Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
f. FEVE Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
g. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
h. Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.

3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.

1. Exposed Finish: Apply the following finish, as specified or indicated on Drawings:

    a. Natural finish.
    b. Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
    c. Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):

        1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

    d. Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally formed patina.

D. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Refer to Division 07 Section "Thermal Insulation."

B. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

C. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (240 kPa), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed.

D. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, [**Type I, Class 1 aluminum foil**] [**Type II, Class 1 or 2 felt or glass-fiber mat, Grade 3**] [**Type V, oriented-strand-board facing**], with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.

E. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density unless otherwise indicated; with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.

F. Molded-Polystyrene Board Insulation: ASTM C 578, [**Type I, 0.9 lb/cu. ft. (15 kg/cu. m)**] [**Type II, 1.35 lb/cu. ft. (22 kg/cu. m)**], with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.

G. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).

H. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from [**glass, slag wool, or rock wool**] [**glass**] [**slag or rock wool**].

1. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
2. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
3. Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).

I. Metal Building Insulation: [**ASTM C 991, Type I, or NAIMA 202**] [**ASTM C 991, Type II**], glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.

1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:

   a. Composition: [**Polypropylene faced, scrim reinforced, and kraft-paper backing**] [**Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating**] [**Polypropylene faced, scrim reinforced, and foil backing**] [**Vinyl faced, scrim reinforced, and foil backing**] [**Vinyl faced, scrim reinforced, and polyester backing**] <**Insert facing**>.

2. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed, galvanized-steel or PVC retainer clips colored to match insulation facing.
3. Thermal Spacer Blocks: Fabricated from extruded polystyrene, 1 inch (25 mm) thick.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
3. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

    a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
    b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
    c. Henry Company; Blueskin PE200 HT.
    d. Metal-Fab Manufacturing, LLC; MetShield.
    e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
    f. <**Insert manufacturer's name; product name or designation**>.

B. Felts: ASTM D 226, [**Type II (No. 30)**] [**Type I (No. 15)**], asphalt-saturated organic felts.

C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 SUBSTRATE BOARDS

A. Gypsum Board: Type X, of thickness indicated, with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges. ASTM C 1396/C 1396M.

B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Type and Thickness: [**Regular, 1/2 inch (13 mm)**] [**Type X, 5/8 inch (16 mm)**].
2. Product: Subject to compliance with requirements, provide Dens-Dek by Georgia-Pacific Corporation.

C. Perlite Board: ASTM C 728, 1 inch (25 mm) thick.

D. Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

2.5 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, [**ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized**] [**ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized**] or coating with equivalent corrosion resistance unless otherwise indicated.

B. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: [**As indicated**] [**As required to meet performance requirements**] [**0.025 inch (0.64 mm)**] [**0.040 inch (1.02 mm)**] <**Insert thickness**>.

2. Depth: [**As indicated**] [**7/8 inch (22 mm)**] [**1-1/2 inches (38 mm)**] <**Insert depth**>.

C. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.

1. Nominal Thickness: [**As indicated**] [**As required to meet performance requirements**] [**0.064 inch (1.63 mm)**] <**Insert thickness**>.
2. Depth: [**As indicated**] [**3/4 inch (19 mm)**] <**Insert depth**>.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.

1. Nominal Thickness: [**As indicated**] [**As required to meet performance requirements**] [**0.025 inch (0.64 mm)**] <**Insert thickness**>.

E. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.6 MISCELLANEOUS MATERIALS

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

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 EXPOSED-FASTENER, LAP-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Corrugated-Profile, Exposed-Fastener Metal Roof Panels <**Insert drawing designation**>: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Alcoa Inc.
    c. CENTRIA Architectural Systems.
    d. Copper Sales, Inc.
    e. Fabral.
    f. Flexospan Steel Buildings, Inc.
    g. Galvamet; Galvacer Building Systems.
    h. MBCI; a division of NCI Building Systems, L. P.
    i. McElroy Metal, Inc.
    j. Metal Sales Manufacturing Corporation.
    k. Metecno-Morin Corporation; Division of Metecno Inc.
    l. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**21.3 inches (541 mm)**] [**29.3 inches (744 mm)**] [**34.67 inches (881 mm)**] [**37.3 inches (947 mm)**] [**42.67 inches (1084 mm)**] [**45.3 inches (1151 mm)**] <**Insert dimension**>.
7. Panel Height: [**0.5 inch (13 mm)**] [**0.875 inch (22 mm)**] <**Insert dimension**>.

C. Tapered-Rib-Profile, Exposed-Fastener Metal Roof Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Architectural Metal Systems.
    c. Berridge Manufacturing Company.
    d. Butler Manufacturing; a BlueScope Steel company.
    e. CENTRIA Architectural Systems.
    f. Copper Sales, Inc.
    g. Fabral.
    h. Flexospan Steel Buildings, Inc.
    i. Galvamet; Galvacer Building Systems.
    j. MBCI; a division of NCI Building Systems, L. P.
    k. McElroy Metal, Inc.
    l. Metal Sales Manufacturing Corporation.
    m. Metecno-Morin; Division of Metecno Inc.
    n. Petersen Aluminum Corporation.
    o. Steelox Systems, L.L.C.
    p. United Steel Deck Inc.; Subsidiary of Bouras Industries Inc.
    q. VICWEST; Div. of Jenisys Engineered Products.
    r. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Major-Rib Spacing: [**6 inches (152 mm)**] [**8 inches (203 mm)**] [**9 inches (229 mm)**] [**12 inches (305 mm)**] <**Insert dimension**> o.c.
8. Panel Coverage: [**24 inches (610 mm)**] [**36 inches (914 mm)**] <**Insert dimension**>.
9. Panel Height: [**0.625 inch (16 mm)**] [**0.75 inch (19 mm)**] [**1.0 inch (25 mm)**] [**1.25 inches (32 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

D. Vee-Rib-Profile, Exposed-Fastener Metal Roof Panels <**Insert drawing designation**>: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. AEP-Span.
b. Alcoa Inc.
c. Berridge Manufacturing Company.
d. CENTRIA Architectural Systems.
e. Fabral.
f. Flexospan Steel Buildings, Inc.
g. MBCI; a division of NCI Building Systems, L. P.
h. Metal Sales Manufacturing Corporation.
i. Metecno-Morin; Division of Metecno Inc.
j. United Steel Deck Inc.; Subsidiary of Bouras Industries Inc.

k. VICWEST; Div. of Jenisys Engineered Products.
l. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Rib Spacing: [**5.3 inches (135 mm)**] [**7.2 inches (183 mm)**] [**12 inches (305 mm)**] <**Insert dimension**> o.c.
7. Panel Coverage: [**30 inches (762 mm)**] [**32 inches (813 mm)**] [**36 inches (914 mm)**] [**40 inches (1016 mm)**] <**Insert dimension**>.
8. Panel Height: [**1.375 inches (35 mm)**] [**1.5 inches (38 mm)**] [**1.75 inches (44 mm)**] [**2.0 inches (51 mm)**] [**3.0 inches (76 mm)**] <**Insert dimension**>.

E. Box-Rib-Profile, Exposed-Fastener Metal Roof Panels <**Insert drawing designation**>: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. Alcoa Inc.
    b. Fabral.
    c. MBCI; a division of NCI Building Systems, L. P.
    d. Metal Sales Manufacturing Corporation.
    e. United Steel Deck Inc.; Subsidiary of Bouras Industries Inc.
    f. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Rib Spacing: [**2.67 inches (68 mm)**] [**4.0 inches (102 mm)**] [**5.3 inches (135 mm)**] [**6.0 inches (152 mm)**] <**Insert dimension**> o.c.
7. Panel Coverage: [**24 inches (610 mm)**] [**28 inches (711 mm)**] [**30 inches (762 mm)**] [**32 inches (813 mm)**] [**36 inches (914 mm)**] <**Insert dimension**>.
8. Panel Height: [**0.625 inch (16 mm)**] [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**2.0 inches (51 mm)**] <**Insert dimension**>.

F. Deep-Box-Rib-Profile, Exposed-Fastener Metal Roof Panels <**Insert drawing designation**>: Formed with raised, box-shaped ribs that are wider than recesses,

evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. CENTRIA Architectural Systems.
    b. Fabral.
    c. Metal Sales Manufacturing Corporation.
    d. Metecno-Morin; Division of Metecno Inc.
    e. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Rib Spacing: [**12 inches (305 mm)**] <**Insert dimension**> o.c.
7. Panel Coverage: [**24 inches (610 mm)**] <**Insert dimension**>.
8. Panel Height: [**3 inches (76 mm)**] [**4 inches (102 mm)**] <**Insert dimension**>.

2.8 CONCEALED-FASTENER, LAP-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps. Include accessories required for weathertight installation.

B. Tapered-Rib-Profile, Concealed-Fastener Metal Roof Panels **<Insert drawing designation>**: Formed with raised, trapezoidal major rib at panel edge and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major rib and panel edge.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

    a. AEP-Span.
    b. Alcoa Inc.
    c. McElroy Metal, Inc.
    d. Metal Sales Manufacturing Corporation.
    e. **<Insert manufacturer's name>**.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] **<Insert finish>**.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] **<Insert color>**.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] **<Insert finish>**.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] **<Insert color>**.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] **<Insert finish>**.

b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] <**Insert dimension**>.
7. Panel Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**1.75 inches (44 mm)**] <**Insert dimension**>.

C. Standing-Seam-Profile, Concealed-Fastener Metal Roof Panels <**Insert drawing designation**>: Formed with raised, curved-top, standing-seam-shaped major rib at panel edge and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major rib and panel edge.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. Cheney Flashing Company.
b. Copper Sales, Inc.
c. Dimensional Metals, Inc.
d. Englert, Inc.
e. Metal Fab Manufacturing.
f. Metal Sales Manufacturing Corporation.
g. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Panel Coverage: [**10 inches (254 mm)**] [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] <**Insert dimension**>.
8. Panel Height: [**1.0 inch (25 mm)**] [**1.25 inches (32 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

D. Batten-Seam-Profile, Concealed-Fastener Metal Roof Panels <**Insert drawing designation**>: Formed with raised, batten-seam-shaped major rib at panel edge and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major rib and panel edge.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. Berridge Manufacturing Company.
b. Cheney Flashing Company.
c. Englert, Inc.
d. Merchant & Evans.
e. Metal Sales Manufacturing Corporation.
f. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**10 inches (254 mm)**] [**12 inches (305 mm)**] [**14 inches (356 mm)**] [**15 inches (381 mm)**] [**18 inches (457 mm)**] [**24 inches (610 mm)**] [**36 inches (914 mm)**] <**Insert dimension**>.
7. Panel Height: [**0.75 inch (19 mm)**] [**1.25 inches (32 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.
8. Batten Width: [**1.5 inches (38 mm)**] [**2.0 inches (51 mm)**] <**Insert dimension**>.

2.9 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels <**Insert drawing designation**>: Formed with vertical ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. AEP-Span.

b. Architectural Building Components.
c. Architectural Metal Systems.
d. Architectural Roofing and Siding, Inc.
e. Butler Manufacturing; a BlueScope Steel company.
f. CENTRIA Architectural Systems.
g. Dimensional Metals, Inc.
h. Englert, Inc.
i. Fabral.
j. IMETCO.
k. Integris Metals.
l. MBCI; a division of NCI Building Systems, L. P.
m. McElroy Metal, Inc.
n. Merchant & Evans.
o. Metal-Fab Manufacturing, LLC.
p. Metal Sales Manufacturing Corporation.
q. Metecno-Morin; Division of Metecno Inc.
r. Modern Metal Systems, Inc.
s. Petersen Aluminum Corporation.
t. Ultra Seam Incorporated.
u. VICWEST; Div. of Jenisys Engineered Products.
v. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

    a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Batten: Same material, finish, and color as roof panels.
8. Clips: [**Fixed**] [**Floating to accommodate thermal movement**].

    a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.
    b. Material: [**0.025-inch- (0.64-mm-)**] [**0.062-inch- (1.59-mm-)**] thick, stainless-steel sheet.

9. Panel Coverage: [**10 inches (254 mm)**] [**12 inches (305 mm)**] [**14 inches (356 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] [**24 inches (610 mm)**] <**Insert dimension**>.
10. Panel Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**1.75 inches (44 mm)**] <**Insert dimension**>.

C. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels <**Insert drawing designation**>: Formed with vertical ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Architectural Building Components.
    c. Architectural Metal Systems.
    d. Architectural Roofing and Siding, Inc.
    e. ATAS International, Inc.
    f. Berridge Manufacturing Company.
    g. Butler Manufacturing; a BlueScope Steel company.
    h. CENTRIA Architectural Systems.
    i. Copper Sales, Inc.
    j. Dimensional Metals, Inc.
    k. Englert, Inc.
    l. Fabral.
    m. Flexospan Steel Buildings, Inc.
    n. Integris Metals.
    o. MBCI; a division of NCI Building Systems, L. P.
    p. McElroy Metal, Inc.

q. Merchant & Evans.
r. Metal-Fab Manufacturing, LLC.
s. Metal Sales Manufacturing Corporation.
t. Metecno-Morin; Division of Metecno Inc.
u. Petersen Aluminum Corporation.
v. Steelox Systems, L.L.C.
w. Ultra Seam Incorporated.
x. United Steel Deck Inc.; Subsidiary of Bouras Industries Inc.
y. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

   a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Batten: Same material, finish, and color as roof panels.
8. Clips: [**Fixed**] [**Floating to accommodate thermal movement**].

a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.
b. Material: [**0.025-inch- (0.64-mm-)**] [**0.062-inch- (1.59-mm-)**] thick, stainless-steel sheet.

9. Joint Type: [**Single folded**] [**Double folded**] [**As standard with manufacturer**].
10. Panel Coverage: [**12 inches (305 mm)**] [**14 inches (356 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] [**20 inches (508 mm)**] [**24 inches (610 mm)**] <**Insert dimension**>.
11. Panel Height: [**1.5 inches (38 mm)**] [**2.0 inches (51 mm)**] [**2.5 inches (64 mm)**] <**Insert dimension**>.

D. Trapezoidal-Rib, Snap-Joint, Standing-Seam Metal Roof Panels <**Insert drawing designation**>: Formed with raised trapezoidal ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. AEP-Span.
b. Galvamet; Galvacer Building Systems.
c. MBCI; a division of NCI Building Systems, L. P.
d. McElroy Metal, Inc.
e. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Clips: [**Fixed**] [**Floating to accommodate thermal movement**].

a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.

6. Panel Coverage: [**12 inches (305 mm)**] [**18 inches (457 mm)**] [**24 inches (610 mm)**] <**Insert dimension**>.
7. Panel Height: [**3 inches (76 mm)**] <**Insert dimension**>.

E. Trapezoidal-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels <**Insert drawing designation**>: Formed with raised trapezoidal ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. Galvamet; Galvacer Building Systems.
b. MBCI; a division of NCI Building Systems, L. P.
c. Metal Sales Manufacturing Corporation.
d. Metecno-Morin; Division of Metecno Inc.
e. Steelox Systems, L.L.C.
f. VICWEST; Div. of Jenisys Engineered Products.
g. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Clips: [**Fixed**] [**Floating to accommodate thermal movement**].

a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.

6. Joint Type: [**Single folded**] [**Double folded**] [**As standard with manufacturer**].
7. Panel Coverage: [**12 inches (305 mm)**] [**18 inches (457 mm)**] [**24 inches (610 mm)**] <**Insert dimension**>.
8. Panel Height: [**2.7 inches (69 mm)**] [**3.0 inches (76 mm)**] <**Insert dimension**>.

F. Integral-Standing-Seam Metal Roof Panels <**Insert drawing designation**>: Formed with integral ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and interconnecting side edges of adjacent panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. AEP-Span.
b. ATAS International, Inc.
c. Cheney Flashing Company.
d. Petersen Aluminum Corporation.
e. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Clips: [**Fixed**] [**Floating to accommodate thermal movement**].

a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.
b. Material: [**0.025-inch- (0.64-mm-)**] [**0.062-inch- (1.59-mm-)**] thick, stainless-steel sheet.

8. Panel Coverage: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] <**Insert dimension**>.
9. Panel Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**2.0 inches (51 mm)**] <**Insert dimension**>.

2.10 BATTEN-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panel assembly designed to be installed by covering vertical side edges of adjacent panels with battens and mechanically attaching panels to supports using concealed clips. Include battens and accessories required for weathertight installation.

B. Narrow-Profile, Snap-on-Batten-Seam Metal Roof Panels <**Insert drawing designation**>: Formed with vertical ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for independent installation by mechanically attaching panels to supports using concealed clips located under 1 side of panels and engaging opposite edge of adjacent panels, and installation of 3/8-to-1/2-inch- (10-to-13-mm-) wide, snap-on battens over panel joints.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Architectural Building Components.
    c. ATAS International, Inc.
    d. CENTRIA Architectural Systems.
    e. Copper Sales, Inc.
    f. Fabral.
    g. Fashion, Inc.
    h. IMETCO.
    i. Integris Metals.
    j. MBCI; a division of NCI Building Systems, L. P.
    k. McElroy Metal, Inc.
    l. Merchant & Evans.
    m. Metal-Fab Manufacturing, LLC.
    n. Metal Sales Manufacturing Corporation.
    o. Petersen Aluminum Corporation.
    p. Ultra Seam Incorporated.
    q. <**Insert manufacturer's name**>.

3. Panel Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Panel Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Panel Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Batten Material: [**Same material, finish, and color as roof panels**] <**Insert material and finish requirements**>.
8. Clips: [**One**] [**Two**] piece.

a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.
b. Material: [**0.025-inch- (0.64-mm-)**] [**0.062-inch- (1.59-mm-)**] thick, stainless-steel sheet.

9. Sealant: Factory applied [**in top**] [**on each side**] of battens.
10. Panel Coverage: [**12 inches (305 mm)**] [**14 inches (356 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] [**20 inches (508 mm)**] <**Insert dimension**>.
11. Batten Height: [**1.0 inch (25 mm)**] [**1.25 inches (32 mm)**] [**1.5 inches (38 mm)**] [**1.75 inches (44 mm)**] [**2.0 inches (51 mm)**] <**Insert dimension**>.

C. Wide-Profile, Snap-on-Batten-Seam Metal Roof Panels <**Insert drawing designation**>: Formed with vertical ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for independent installation by mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and installing snap-on battens over panel joints.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. AEP-Span.
b. Architectural Building Components.
c. Architectural Roofing and Siding, Inc.
d. ATAS International, Inc.
e. CENTRIA Architectural Systems.
f. Copper Sales, Inc.
g. Dimensional Metals, Inc.
h. Fabral.
i. Fashion, Inc.
j. IMETCO.
k. MBCI; a division of NCI Building Systems, L. P.

l. McElroy Metal, Inc.
m. Merchant & Evans.
n. Metal-Fab Manufacturing, LLC.
o. Metal Sales Manufacturing Corporation.
p. Petersen Aluminum Corporation.
q. <**Insert manufacturer's name**>.

3. Panel Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Panel Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Panel Material: Aluminum sheet, [**0.024 inch (0.061 mm)**] [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

   a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Batten Material: [**Same material, finish, and color as roof panels**] <**Insert material and finish requirements**>.
8. Clips: One piece.

   a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.

b. Material: [**0.025-inch- (0.64-mm-)**] [**0.062-inch- (1.59-mm-)**] thick, stainless-steel sheet.

9. Sealant: Factory applied on each side of battens.
10. Panel Coverage: [**12 inches (305 mm)**] [**14 inches (356 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] [**22 inches (559 mm)**] [**24 inches (610 mm)**] <**Insert dimension**>.
11. Batten Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**1.75 inches (44 mm)**] [**1.88 inches (48 mm)**] [**2.0 inches (51 mm)**] <**Insert dimension**>.

D. Seamed-Batten Metal Roof Panels <**Insert drawing designation**>: Formed with vertical ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**smooth, flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and installing mechanically seamed battens over panel joints.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. CENTRIA Architectural Systems.
b. Englert, Inc.
c. IMETCO.
d. Integris Metals.
e. <**Insert manufacturer's name**>.

3. Panel Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Panel Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Panel Material: Aluminum sheet, [**0.024 inch (0.061 mm)**] [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

    a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

7. Batten Material: [**Same material, finish, and color as roof panels**] <**Insert material and finish requirements**>.
8. Clips: [**One**] [**Two**] piece.

    a. Material: [**0.028-inch- (0.71-mm-)**] [**0.064-inch- (1.63-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.
    b. Material: [**0.025-inch- (0.64-mm-)**] [**0.062-inch- (1.59-mm-)**] thick, stainless-steel sheet.

9. Sealant: Factory applied on each side of clips under battens.
10. Panel Coverage: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**18 inches (457 mm)**] <**Insert dimension**>.
11. Batten Height: [**2.0 inches (51 mm)**] [**2.375 inches (60 mm)**] [**3.0 inches (76 mm)**] <**Insert dimension**>.

2.11 HORIZONTAL-SEAM (BERMUDA-TYPE) METAL ROOF PANELS

A. Horizontal-Seam (Bermuda-Type) Metal Roof Panels <**Insert drawing designation**>: Formed with horizontal seam at panel edges and smooth, flat pan; designed to be installed in sequential installation by engaging lower edge of each panel to upper edge of panel below and mechanically attaching panels to supports using concealed clips located under upper edge of panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Berridge Manufacturing Company.
    c. Copper Sales, Inc.

d. **<Insert manufacturer's name>**.

3. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, 0.032 inch (0.81 mm) thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

   a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**].

7. Clips: One piece.

   a. Material: 0.028-inch- (0.71-mm-) nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.
   b. Material: 0.025-inch- (0.64-mm-) thick, stainless-steel sheet.

8. Seal: Factory-applied sealant or vinyl weatherseal in seam.
9. Exposure: [**9.5 inches (241 mm)**] [**11 inches (279 mm)**] <**Insert dimension**> nominal.
10. Seam Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

2.12 FOAMED-INSULATION-CORE METAL ROOF PANELS

A. General: Provide factory-formed and -assembled metal roof panels fabricated from two sheets of metal with insulation core foamed-in-place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Panel Performance:

a. Flatwise Tensile Strength: 30 psi (200 kPa) when tested according to ASTM C 297/C 297M.
b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.
d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
f. Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
g. Fire-Test-Response Characteristics: Class A according to ASTM E 108.

2. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.

a. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
b. Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
c. Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D 1621.
d. Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273.

B. Lap-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels <**Insert drawing designation**>: Formed for lapping side edges of adjacent panels and mechanically attaching to supports using exposed fasteners in side laps.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. Architectural Metal Systems.
b. Coldmatic Building Systems.

c. Galvamet; Galvacer Building Systems.
d. Insulated Panel Systems; a division of NCI Building Systems, L.P.
e. Metecno-Aluma Shield; Division of Metecno Inc.
f. Metl-Span.
g. <**Insert manufacturer's name**>.

3. Facings: Fabricate panel with exterior and interior facings of same material and thickness.

a. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.
b. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.
c. Exterior Facing Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

d. Interior Facing Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Batten: Same material, finish, and color as exterior facings of roof panels.
5. Panel Coverage: [**24 inches (610 mm)**] [**30 inches (762 mm)**] [**36 inches (914 mm)**] [**39.6 inches (1000 mm)**] [**40 inches (1016 mm)**] [**44.5 inches (1130 mm)**] <**Insert dimension**>.
6. Panel Thickness: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**2.0 inches (51 mm)**] [**2.5 inches (64 mm)**] [**3.0 inches (76 mm)**] [**4.0 inches (102 mm)**] [**5.0 inches (127 mm)**] [**6.0 inches (152 mm)**] <**Insert dimension**>.
7. Thermal-Resistance Value (R-Value): <**Insert R-value**>.

C. Standing-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels <**Insert drawing designation**>: Formed with vertical tongue-and-groove ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by interlocking tongue-and-groove panel edges and mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and mechanically seaming panels together.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. Architectural Metal Systems.
b. Butler Manufacturing; a BlueScope Steel company.
c. Insulated Panel Systems; a division of NCI Building Systems, L.P.
d. Metl-Span.
e. <**Insert manufacturer's name**>.

3. Facings: Fabricate panel with exterior and interior facings of same material and thickness.

a. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.
b. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.
c. Exterior Facing Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

d. Interior Facing Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Joint Type: [**Single folded**] [**Double folded**] [**As standard with manufacturer**].
5. Panel Coverage: [**36 inches (914 mm)**] [**42 inches (1067 mm)**] <**Insert dimension**>.
6. Panel Thickness: [**2.0 inches (51 mm)**] [**2.5 inches (64 mm)**] [**3.0 inches (76 mm)**] [**4.0 inches (102 mm)**] [**5.0 inches (127 mm)**] [**6.0 inches (152 mm)**] <**Insert dimension**>.
7. Thermal-Resistance Value (R-Value): <**Insert R-value**>.

D. Batten-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels <**Insert drawing designation**>: Formed with vertical or tapered tongue-and-groove ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by interlocking tongue-and-groove panel edges and mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and installing snap-on battens over panel joints.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. CENTRIA Architectural Systems.
b. Metl-Span.
c. <**Insert manufacturer's name**>.

3. Facings: Fabricate panel with exterior and interior facings of same material and thickness.

a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) nominal thickness.
b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) nominal thickness.
c. Exterior Facing Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

d. Interior Facing Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Batten: Same material, finish, and color as exterior facings of roof panels.
5. Clips: One piece; [**0.064-inch- (1.63-mm-)**] [**0.097-inch- (2.50-mm-)**] nominal thickness, [**zinc-coated (galvanized)**] [**or**] [**aluminum-zinc alloy-coated**] steel sheet.
6. Panel Coverage: [**36 inches (914 mm)**] [**39.6 inches (1000 mm)**] <**Insert dimension**>.
7. Panel Thickness: [**1.75 inches (44 mm)**] [**2.0 inches (51 mm)**] [**2.5 inches (64 mm)**] [**3.0 inches (76 mm)**] [**4.0 inches (102 mm)**] [**5.0 inches (127 mm)**] [**6.0 inches (152 mm)**] <**Insert dimension**>.
8. Thermal-Resistance Value (R-Value): <**Insert R-value**>.

2.13 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal roof panels.

1. Finish: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated on Drawings**].
2. Sealant: Factory applied within interlocking joint.

C. Flush-Profile Metal Soffit Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Architectural Building Components.
    c. ATAS International, Inc.
    d. Berridge Manufacturing Company.
    e. CENTRIA Architectural Systems.
    f. Copper Sales, Inc.
    g. Dimensional Metals, Inc.
    h. Englert, Inc.
    i. Fabral.
    j. IMETCO.
    k. MBCI; a division of NCI Building Systems, L. P.
    l. McElroy Metal, Inc.
    m. Merchant & Evans.
    n. Metal-Fab Manufacturing, LLC.
    o. Metal Sales Manufacturing Corporation.
    p. Petersen Aluminum Corporation.
    q. Ultra Seam Incorporated.
    r. <**Insert manufacturer's name**>.

3. Material: Same material, finish, and color as metal roof panels.
4. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

7. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**].

8. Panel Coverage: [**8 inches (203 mm)**] [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**20 inches (508 mm)**] <**Insert dimension**>.
9. Panel Height: [**0.875 inch (22 mm)**] [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**3.0 inches (76 mm)**] <**Insert dimension**>.
10. Sealant: Factory applied within interlocking joint.

D. Reveal-Joint-Profile Metal Soffit Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with recessed reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. ATAS International, Inc.
b. Cheney Flashing Company.
c. Copper Sales, Inc.
d. Merchant & Evans.
e. Metal Fab Manufacturing, LLC.
f. Petersen Aluminum Corporation.
g. <**Insert manufacturer's name**>.

3. Material: Same material, finish, and color as metal roof panels.
4. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

7. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**] <**Insert finish**>.

8. Panel Coverage: [**8 inches (203 mm)**] [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**20 inches (508 mm)**] <**Insert dimension**>.
9. Panel Height: [**0.75 inch (19 mm)**] [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

E. V-Groove-Profile Metal Soffit Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with V-groove joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. ATAS International, Inc.
b. Berridge Manufacturing Company.
c. CENTRIA Architectural Systems.
d. Dimensional Metals, Inc.
e. Englert, Inc.
f. Fabral.
g. IMETCO.
h. Petersen Aluminum Corporation.
i. <**Insert manufacturer's name**>.

3. Material: Same material, finish, and color as metal roof panels.
4. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Aluminum sheet, [**0.024 inch (0.65 mm)**] [**0.032 inch (0.81 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].

7. Panel Coverage: [**6 inches (152 mm)**] [**12 inches (305 mm)**] [**14 inches (356 mm)**] <**Insert dimension**>.
8. Panel Height: [**0.375 inch (10 mm)**] [**0.44 inch (11 mm)**] [**0.50 inch (13 mm)**] [**0.625 inch (16 mm)**] <**Insert dimension**>.

2.14 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum [**0.018 inch (0.45 mm)**] <**Insert thickness**> thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from same material roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match [**metal roof panels**] [**roof fascia and rake trim**].

D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.

E. Roof Curbs: Fabricated from same material as roof panels, minimum [**0.048 inch (1.2 mm)**] <**Insert thickness**> thick; with bottom of skirt profiled to match roof panel profiles, and welded top box and integral full-length cricket. Fabricate curb subframing of minimum 0.0598-inch- (1.5-mm-) thick, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.

1. Insulate roof curb with 1-inch- (25-mm-) thick, rigid insulation.

2.15 SNOW GUARDS

A. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.

1. Surface-Mounted, Plastic, Stop-Type Snow Guards: [**Clear**] [**Integral color**] polycarbonate stops designed for attachment to pan surface of metal roof panels using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

    a. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

        1) Berger Bros. Co.; <**Insert product name or designation**>.
        2) Chemlink; <**Insert product name or designation**>
        3) Polar Blox; <**Insert product name or designation**>.
        4) SNOBLOX; <**Insert product name or designation**>.
        5) Sno-Gem, Inc.; <**Insert product name or designation**>.
        6) Snojax Inc.; <**Insert product name or designation**>.
        7) <**Insert manufacturer's name; product name or designation**>.

2. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to pan surface of metal roof panel using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

    a. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

        1) Berger Bros. Co.; <**Insert product name or designation**>.
        2) Mullane, M. J. Company, Inc.; <**Insert product name or designation**>.
        3) Precision Molding Co. Inc.; <**Insert product name or designation**>
        4) Sno-Gem, Inc.; <**Insert product name or designation**>.
        5) Zaleski Snow-Guards & Roofing Specialties; <**Insert product name or designation**>.
        6) <**Insert manufacturer's name; product name or designation**>.

3. Surface-Mounted, Copper, Stop-Type Snow Guards: Bronze-alloy stops designed for attachment to pan surface of copper roof panel using solder.

    a. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

        1) Berger Bros. Co.; <**Insert product name or designation**>.

2) Mullane, M. J. Company, Inc.; <**Insert product name or designation**>.
3) Roofers Edge; <**Insert product name or designation**>
4) Sno-Gem, Inc.; <**Insert product name or designation**>.
5) Zaleski Snow-Guards & Roofing Specialties; <**Insert product name or designation**>.
6) <**Insert manufacturer's name; product name or designation**>.

4. Seam-Mounted, Stop-Type Snow Guards: [**Cast-aluminum**] [**Malleable-iron**] [**Clear polycarbonate**] [**Colored polycarbonate**] stops designed for attachment to vertical ribs of standing-seam metal roof panels with stainless-steel set screws.

a. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

1) Alpine SnowGuards, Div. of Vermont Slate & Copper Services, Inc.; <**Insert product name or designation**>.
2) Berger Bros. Co.; <**Insert product name or designation**>.
3) Polar Blox; <**Insert product name or designation**>.
4) <**Insert manufacturer's name; product name or designation**>.

5. Seam-Mounted, Bar-Type Snow Guards: [**Aluminum**] [**or**] [**stainless-steel**] rods or bars held in place by stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

a. Aluminum Finish: [**Mill**] [**Clear anodized**] <**Insert finish**>.
b. Stainless-Steel Finish: [**Mill**] [**No. 2B**] [**No. 4**] <**Insert finish**>.
c. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

1) Alpine SnowGuards, Div. of Vermont Slate & Copper Services, Inc.; <**Insert product name or designation**>.
2) LMCurbs; <**Insert product name or designation**>.
3) Metal Roof Innovations, Ltd.; <**Insert product name or designation>.**
4) Riddell & Company, Inc.; <**Insert product name or designation**>.
5) Snow Management Systems, a division of Contek, Inc.; <**Insert product name or designation**>.
6) TRA-MAGE, Inc.; <**Insert product name or designation**>.
7) <**Insert manufacturer's name; product name or designation**>.

2.16 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to

fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. End Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.17 FINISHES

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

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

B. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

C. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

D. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Substrate Board: Install substrate boards over roof [**deck**] [**sheathing**] on entire roof surface. Attach with substrate-board fasteners.

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
2. Comply with [**UL**] [**FMG**] requirements for fire-rated construction.

C. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

1. Soffit Framing: Wire tie[**or clip**] furring channels to supports[**, as required to comply with requirements for assemblies indicated**].

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at

locations indicated [**below**] [**on Drawings**], wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm).[**Extend underlayment into gutter trough.**] Roll laps with roller. Cover underlayment within 14 days.

1. Roof perimeter for a distance up from eaves of [**24 inches (600 mm)**] [**36 inches (914 mm)**] <**Insert dimension**> beyond interior wall line.
2. Valleys, from lowest point to highest point, for a distance on each side of [**18 inches (460 mm)**] <**Insert dimension**>. Overlap ends of sheets not less than 6 inches (150 mm).
3. Rake edges for a distance of [**18 inches (460 mm)**] <**Insert dimension**>.
4. Hips and ridges for a distance on each side of [**12 inches (300 mm)**] <**Insert dimension**>.
5. Roof to wall intersections for a distance from wall of [**18 inches (460 mm)**] <**Insert dimension**>.
6. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of [**18 inches (460 mm)**] <**Insert dimension**>.

B. Felt Underlayment: Apply at locations indicated [**below**] [**on Drawings**], in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).

1. Apply over entire roof surface.
2. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.

C. Apply slip sheet over underlayment before installing metal roof panels.

D. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.4 THERMAL INSULATION INSTALLATION

A. Polyethylene Vapor Retarder: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Repair tears or punctures immediately before concealment by other work.

B. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation."

1. Erect insulation and hold in place with Z-shaped furring members spaced [**24 inches (610 mm)**] [**600 mm**] o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches (600 mm) o.c.

C. Blanket Insulation: Install insulation concurrently with metal roof panel installation, in thickness indicated to cover entire roof, according to manufacturer's written instructions and as follows:

1. Set vapor-retarder-faced units with vapor retarder [**to warm side**] [**in location indicated**] <**Insert location**> of construction unless otherwise indicated. Do not obstruct ventilation spaces.
2. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
3. Install blankets straight and true in one-piece lengths with both sets of facing tabs sealed. Comply with the following installation method:

    a. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.
    b. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlin, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
    c. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by roof panel standoffs. Hold in place by panels fastened to standoffs.
    d. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlins, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

4. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
5. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

3.5 METAL ROOF PANEL INSTALLATION, GENERAL

A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.

1. Point of Fixity: Fasten each panel along a single line of fixing located at [**eave**] [**ridge**] [**center of panel length**] [**locations indicated on Drawings**] <**Insert location**>.
2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.

C. Install metal roof panels as follows:

1. Commence metal roof panel installation and install minimum of [**300 sq. ft. (27.8 sq. m.)**] <**Insert size**> in presence of factory-authorized representative.

2. Field cutting of metal panels by torch is not permitted.
3. Install panels perpendicular to purlins.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Provide metal closures at [**rake edges**] [**rake walls**] [**and**] each side of ridge[**and hip**] caps.
6. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
7. Install ridge[**and hip**] caps as metal roof panel work proceeds.
8. End Splices: Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
9. Install metal flashing to allow moisture to run over and off metal roof panels.

D. Fasteners:

1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Roof Panels: Use copper, stainless-steel, or hardware-bronze fasteners.

E. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.6 METAL ROOF PANEL INSTALLATION

A. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

2. Lap ribbed or fluted sheets one full rib corrugation.
3. Provide metal-backed neoprene or EPDM washers under heads of exposed fasteners bearing on weather side of metal roof panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
6. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
7. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
8. At panel end splices, nest panels with minimum 6-inch (150-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

C. Batten-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each batten-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling fasteners.
2. Apply battens to metal roof panel seams, fully engaged to provide weathertight joints.

D. Horizontal-Seam (Bermuda-Type) Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each horizontal-seam joint at location, spacing, and with fasteners recommended by manufacturer. Start at eave and work upward toward ridge.

1. Install clips to supports with self-drilling fasteners.

3.7 FOAMED-INSULATION-CORE METAL ROOF PANEL INSTALLATION

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal roof panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

B. Lap-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of insulated metal roof panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Provide sealant tape at lapped joints of insulated metal roof panels and between panels and protruding equipment, vents, and accessories.
5. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weatherproof to driving rains.
6. Apply snap-on battens to insulated metal roof panel seams to conceal fasteners.

C. Standing-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so cleat, insulated metal roof panel, and factory-applied side-lap sealant are completely engaged.

D. Batten-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with concealed clips at each batten-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Apply battens to insulated metal roof panel seams, fully engaged to provide weathertight joints.

3.8 METAL SOFFIT PANEL INSTALLATION

A. In addition to complying with requirements in "Metal Roof Panel Installation, General" Article, install metal soffit panels to comply with requirements in this article.

B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

C. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.9 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.10 SNOW GUARD INSTALLATION

A. Stop-Type Snow Guards: Attach snow guards to metal roof panels with adhesive, sealant, or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate metal roof panels.

1. Provide <**Insert number**> rows of snow guards, at locations indicated on Drawings, spaced <**Insert dimension**> apart, beginning <**Insert dimension**> up from gutter[**, with each snow guard centered between panel ribs**].

B. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam metal roof panels with clamps or set screws. Do not use fasteners that will penetrate metal roof panels.

1. Provide <**Insert number**> rows of snow guards, at locations indicated on Drawings, spaced <**Insert dimension**> apart, beginning <**Insert dimension**> up from gutter.

3.11 ERECTION TOLERANCES

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

3.12 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.

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

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 CLEANING

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

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113

SECTION 074213 - METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam metal wall panels.
2. Concealed-fastener, lap-seam metal wall panels.
3. Metal liner panels.
4. Metal soffit panels.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
2. Division 07 Section "Air Barriers" for continuous air barrier systems.
3. Division 07 Section "Insulated-Core Metal Wall Panels" for foamed-in-place, laminated and honeycomb insulated metal wall panels.
4. Division 07 Section "Metal Plate Wall Panels" for solid metal plate wall panels
5. Division 07 Section "Composite Wall Panels" for metal-faced composite wall panels.
6. Division 07 Section "Sheet Metal Flashing and Trim" for flashing and other sheet metal work that is not part of metal wall panel assemblies.

1.3 DEFINITION

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

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than [**0.06 cfm/sq. ft. (0.3 L/s per sq. m)**] <**Insert rate**> of wall area when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: [**1.57 lbf/sq. ft. (75 Pa)**] <**Insert pressure**>.

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: [**2.86 lbf/sq. ft. (137 Pa)**] <**Insert pressure**>.

E. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than [**6.24 lbf/sq. ft. (300 Pa)**] <**Insert pressure difference**> and not more than 12 lbf/sq. ft. (575 Pa).

1. Water Leakage: As defined according to AAMA 501.1.
2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

F. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

   a. Uniform pressure of [**20 lbf/sq. ft. (957 Pa)**] [**30 lbf/sq. ft. (1436 Pa)**] <**Insert design wind pressure**>, acting inward or outward.
   b. Uniform pressure as indicated on Drawings.

2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than [**1/180**] [**1/240**] <**Insert deflection**> of the span.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): [**120 deg F (67 deg C), ambient; 180 deg F (100 deg C)**] <**Insert temperature range**>, material surfaces.

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

    a. Flashing and trim.
    b. Anchorage systems.

C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal [**Wall**] [**and**] [**Soffit**] Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
2. Trim and Closures: 12 inches (305 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (305-mm-) long Samples for each type of accessory.

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

F. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:

1. Wall panels and attachments.
2. [**Girts**] [**Stud framing**].
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall by pipes and utilities.

G. Qualification Data: For [**Installer**] [**professional engineer**] [**and**] [**testing agency**].

H. Material Certificates: For [**thermal insulation**] [**and**] [**vapor retarders**], signed by manufacturers.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

J. Field quality-control reports.

K. Maintenance Data: For metal wall panels to include in maintenance manuals.

L. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.

D. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical [**wall**] [**corner**] panel[**, including soffit,**] as shown on Drawings; approximately [**one bay wide by one story high**] <**Insert size**> by full thickness, including insulation, supports, attachments, and accessories.
2. Conduct water spray test of mockup of metal wall panel assembly, testing for water penetration according to AAMA 501.2.
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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

E. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.9 COORDINATION

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

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: [**Two**] <**Insert number**> years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: [**20**] [**10**] <**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
3. Surface: [**Smooth, flat**] [**Embossed**] finish.
4. Exposed Coil-Coated Finish:

    a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    b. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    c. 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    d. Mica Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    e. Metallic Fluoropolymer: AAMA 621. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    f. FEVE Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    g. Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
    h. Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.

5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: [**Smooth, flat**] [**Embossed**] finish.
2. Exposed Coil-Coated Finish:

a. 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. 4-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
d. Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
e. Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
f. FEVE Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
g. Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
h. Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.

3. Exposed Anodized Finish:

a. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**] [**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
b. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**] [**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.

1. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.

a. Natural finish.

b. Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
c. Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):

1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

d. Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type [**304**] [**316**], fully annealed.

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
c. Directional Satin Finish: No. 4.

3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

E. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Refer to Division 07 Section "Thermal Insulation."

B. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (241 kPa), with maximum flame-spread index of 75 and smoke-developed index of 450.

C. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, [**Type I (foil facing), Class 1 or 2**] [**Type II (asphalt felt or glass-fiber mat facing), Class 2 or 3, Grade**

3], with maximum flame-spread index of 75 and smoke-developed index of 450, based on tests performed on unfaced core.

D. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m), with maximum flame-spread index of 75 and smoke-developed index of 450.

E. Molded-Polystyrene Board Insulation: ASTM C 578, [**Type I, 0.9 lb/cu. ft. (15 kg/cu. m)**] [**Type II, 1.35 lb/cu. ft. (22 kg/cu. m)**], with maximum flame-spread index of 75 and smoke-developed index of 450.

F. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread index of 25 and smoke-developed index of 50, and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).

G. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from [**glass, slag wool, or rock wool**] [**glass**] [**slag or rock wool**].

1. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
2. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
3. Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).

H. Metal Building Insulation: [**ASTM C 991, Type I; or NAIMA 202**] [**ASTM C 991, Type II**], glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.

1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:

   a. Composition: [**Polypropylene faced, scrim reinforced, and kraft-paper backing**] [**Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating**] [**Polypropylene faced, scrim reinforced, and foil backing**] [**Vinyl faced, scrim reinforced, and foil backing**] [**Vinyl faced, scrim reinforced, and polyester backing**] <**Insert facing**>.

2. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed galvanized steel or PVC retainer clips colored to match insulation facing.

2.3 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, [**ASTM A 653/A 653M, G40s (Z120) hot-dip galvanized**]

[**ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized**] or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.

C. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.

D. Base or Sill [**Angles**] [**Channels**]: 0.079-inch (2.01-mm) nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: [**As indicated**] [**As required to meet performance requirements**] [**0.025 inch (0.64 mm)**] [**0.040 inch (1.02 mm)**] <**Insert thickness**>.
2. Depth: [**As indicated**] [**7/8 inch (22 mm)**] [**1-1/2 inches (38 mm)**] <**Insert depth**>.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.

1. Nominal Thickness: [**As indicated**] [**As required to meet performance requirements**] [**0.064 inch (1.63 mm)**] <**Insert thickness**>.
2. Depth: [**As indicated**] [**3/4 inch (19 mm)**] <**Insert depth**>.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.

1. Nominal Thickness: [**As indicated**] [**As required to meet performance requirements**] [**0.025 inch (0.64 mm)**] <**Insert thickness**>.

H. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 MISCELLANEOUS MATERIALS

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

2.5 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Alcoa Architectural Products (USA).
    c. ATAS International, Inc.
    d. CENTRIA Architectural Systems.
    e. Copper Sales, Inc.
    f. Englert, Inc.
    g. Fabral.
    h. Flexospan Steel Buildings, Inc.
    i. Industrial Building Panels.
    j. MBCI; Div. of NCI Building Systems.
    k. McElroy Metal, Inc.
    l. Metal Sales Manufacturing Corporation.
    m. Metecno-Morin.
    n. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.

b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**21.3 inches (541 mm)**] [**29.3 inches (744 mm)**] [**34.6 inches (881 mm)**] [**37.3 inches (947 mm)**] [**42.6 inches (1084 mm)**] [**45.3 inches (1151 mm)**] <**Insert dimension**>.
7. Panel Height: [**0.5 inch (13 mm)**] [**0.875 inch (22 mm)**] <**Insert dimension**>.

C. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. AEP-Span.
b. Architectural Metal Systems.
c. Berridge Manufacturing Company.
d. Butler Manufacturing Company
e. CENTRIA Architectural Systems.
f. Copper Sales, Inc.
g. Englert, Inc.
h. Fabral.
i. Flexospan Steel Buildings, Inc.
j. Galvamet.
k. MBCI; Div. of NCI Building Systems.
l. McElroy Metal, Inc.
m. Metal Sales Manufacturing Corporation.
n. Metecno-Morin.
o. Petersen Aluminum Corporation.
p. Steelox Systems, L.L.C.
q. United Steel Deck, Inc.; Subsidiary of Bouras Industries Inc.
r. VICWEST; Div. of Jenisys Engineered Products.
s. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Major-Rib Spacing: [**6 inches (152 mm)**] [**8 inches (203 mm)**] [**9 inches (229 mm)**] [**12 inches (305 mm)**] <**Insert dimension**> o.c.
7. Panel Coverage: [**24 inches (610 mm)**] [**36 inches (914 mm)**] <**Insert dimension**>.
8. Panel Height: [**0.625 inch (16 mm)**] [**0.75 inch (19 mm)**] [**1.0 inch (25 mm)**] [**1.25 inches (32 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

D. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with recessed, trapezoidal major valleys and [**intermediate stiffening valleys symmetrically spaced**] [**flat pan**] between major valleys.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. Architectural Metal Systems.

b. Flexospan Steel Buildings, Inc.
c. Steelox Systems, L.L.C.
d. United Steel Deck, Inc.; Subsidiary of Bouras Industries Inc.
e. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Major-Rib Spacing: [**12 inches (305 mm)**] <**Insert dimension**> o.c.
6. Panel Coverage: [**36 inches (914 mm)**] <**Insert dimension**>.
7. Panel Height: [**1.25 inches (32 mm)**] <**Insert dimension**>.

E. Vee-Rib-Profile, Exposed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

   a. AEP-Span.
   b. Alcoa Architectural Products (USA).
   c. ATAS International, Inc.
   d. CENTRIA Architectural Systems.
   e. Copper Sales, Inc.
   f. Englert, Inc.
   g. Fabral.
   h. Flexospan Steel Buildings, Inc.

i. Galvamet.
j. Industrial Building Panels.
k. MBCI; Div. of NCI Building Systems.
l. McElroy Metal, Inc.
m. Metal Sales Manufacturing Corporation.
n. Metecno-Morin.
o. United Steel Deck, Inc.; Subsidiary of Bouras Industries Inc.
p. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Rib Spacing: [**5.3 inches (135 mm)**] [**7.2 inches (183 mm)**] [**12 inches (305 mm)**] <**Insert dimension**> o.c.
7. Panel Coverage: [**30 inches (762 mm)**] [**32 inches (813 mm)**] [**36 inches (914 mm)**] [**40 inches (1016 mm)**] <**Insert dimension**>.
8. Panel Height: [**1.375 inches (35 mm)**] [**1.5 inches (38 mm)**] [**1.75 inches (44 mm)**] [**2.0 inches (51 mm)**] [**3.0 inches (76 mm)**] <**Insert dimension**>.

F. Box-Rib-Profile, Exposed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Alcoa Architectural Products (USA).
    c. Fabral.
    d. Galvamet.
    e. Industrial Building Panels.
    f. MBCI; Div. of NCI Building Systems.
    g. Metal Sales Manufacturing Corporation.
    h. United Steel Deck, Inc.; Subsidiary of Bouras Industries Inc.
    i. VICWEST; Div. of Jenisys Engineered Products.
    j. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.

b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Rib Spacing: [**2.67 inches (68 mm)**] [**4.0 inches (102 mm)**] [**5.3 inches (135 mm)**] [**6.0 inches (152 mm)**] <**Insert dimension**> o.c.
7. Panel Coverage: [**24 inches (610 mm)**] [**28 inches (711 mm)**] [**30 inches (762 mm)**] [**32 inches (813 mm)**] [**36 inches (914 mm)**] <**Insert dimension**>.
8. Panel Height: [**0.625 inch (16 mm)**] [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**2.0 inches (51 mm)**] <**Insert dimension**>.

G. Deep-Box-Rib-Profile, Exposed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. ATAS International, Inc.
b. CENTRIA Architectural Systems.
c. Fabral.
d. Metal Sales Manufacturing Corporation.
e. Metecno-Morin.
f. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] [**0.064-inch (1.63-mm)**] nominal thickness.

a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Rib Spacing: [**12 inches (305 mm)**] <**Insert dimension**> o.c.
7. Panel Coverage: [**24 inches (610 mm)**] <**Insert dimension**>.
8. Panel Height: [**3.0 inches (76 mm)**] [**4.0 inches (102 mm)**] <**Insert dimension**>.

2.6 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Alcoa Architectural Products (USA).
    c. Architectural Building Components.
    d. Architectural Metal Systems.
    e. ATAS International, Inc.
    f. Berridge Manufacturing Company.
    g. CENTRIA Architectural Systems.
    h. Dimension Metals, Inc.
    i. Fabral.
    j. Flexospan Steel Buildings, Inc.
    k. Industrial Building Panels.
    l. MBCI; Div. of NCI Building Systems.
    m. Metal-Fab Manufacturing, L.L.C.
    n. Metecno-Morin.
    o. Petersen Aluminum Corporation.
    p. United Steel Deck, Inc.; Subsidiary of Bouras Industries Inc.

q. VICWEST; Div. of Jenisys Engineered Products.
r. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**12 inches (305 mm)**] <**Insert dimension**>.
7. Panel Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

C. Reveal-Joint, Concealed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with narrow reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

   a. ATAS International, Inc.

b. CENTRIA Architectural Systems.
c. Metal Sales Manufacturing Corporation.
d. Metecno-Morin.
e. Petersen Aluminum Corporation.
f. **<Insert manufacturer's name>**.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] **<Insert finish>**.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] **<Insert color>**.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] **<Insert finish>**.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] **<Insert color>**.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] **<Insert finish>**.
   b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] **<Insert color>**.

6. Panel Coverage: [**12 inches (305 mm)**] **<Insert dimension>**.
7. Panel Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] **<Insert dimension>**.

D. Wide-Reveal-Joint, Concealed-Fastener Metal Wall Panels **<Insert drawing designation>**: Formed with vertical panel edges and stepped profile between panel edges resulting in wide reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. Alcoa Architectural Products (USA).
    b. Architectural Metal Systems.
    c. ATAS International, Inc.
    d. CENTRIA Architectural Systems.
    e. Fabral.
    f. Flexospan Steel Buildings, Inc.
    g. Industrial Building Panels.
    h. Metecno-Morin.
    i. Steelox Systems, L.L.C.
    j. United Steel Deck, Inc.; Subsidiary of Bouras Industries Inc.
    k. VICWEST; Div. of Jenisys Engineered Products.
    l. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**12 inches (305 mm)**] <**Insert dimension**>.

7. Panel Height: [**1.5 inches (38 mm)**] <**Insert dimension**>.

E. V-Groove-Profile, Concealed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. ATAS International, Inc.
    b. Berridge Manufacturing Company.
    c. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] <**Insert dimension**> nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Panel Coverage: [**6 inches (152 mm)**] [**8 inches (203 mm)**] [**12 inches (305 mm)**] <**Insert dimension**>.
6. Panel Height: [**0.625 inch (16 mm)**] [**1.25 inches (32 mm)**] <**Insert dimension**>.

F. Tapered-Rib-Profile, Concealed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. ATAS International, Inc.
    b. Dimensional Metals, Inc.
    c. Metal Sales Manufacturing Corporation.
    d. Metecno-Morin.
    e. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] <**Insert dimension**> nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Panel Coverage: [**12 inches (305 mm)**] [**14 inches (356 mm)**] <**Insert dimension**>.
6. Panel Height: [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

G. Curved-Rib-Profile, Concealed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, curved-side major ribs and flat pan between major ribs; with reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. Alcoa Architectural Products (USA).
    b. ATAS International, Inc.
    c. Metecno-Morin.
    d. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] [**0.050 inch (1.27 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**12 inches (305 mm)**] <**Insert dimension**>.
7. Panel Height: [**0.875 inch (22 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

H. Creased-Profile, Concealed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with vertical panel edges and center-creased pan between panel edges; with flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. Metecno-Morin.
    b. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**12 inches (305 mm)**] <**Insert dimension**>.
7. Panel Height: [**1.5 inches (38 mm)**] <**Insert dimension**>.

I. Creased-Rib-Profile, Concealed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. Alcoa Architectural Products (USA).
    b. ATAS International, Inc.
    c. Metecno-Morin.
    d. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**12 inches (305 mm)**] <**Insert dimension**>.
7. Panel Height: [**0.875 inch (22 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

2.7 METAL LINER PANELS

A. General: Provide factory-formed metal liner panels designed for interior side of metal wall panel assemblies and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps. Include accessories required for a complete installation.

B. Flush-Profile Metal Liner Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. Alcoa Architectural Products (USA).
    b. Architectural Metal Systems.
    c. Berridge Manufacturing Company.
    d. CENTRIA Architectural Systems.
    e. Englert, Inc.
    f. Fabral.
    g. Flexospan Steel Buildings, Inc.
    h. MBCI; Div. of NCI Building Systems.
    i. Metal Sales Manufacturing Corporation.
    j. Metecno-Morin.
    k. <**Insert manufacturer's name**>.

3. Material: Zinc-coated (galvanized) steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

4. Material: Aluminum-zinc alloy-coated steel sheet, [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Panel Coverage: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**24 inches (610 mm)**] [**36 inches (914 mm)**] <**Insert dimension**>.
7. Panel Height: [**1.5 inches (38 mm)**] [**2.0 inches (51 mm)**] [**3.0 inches (76 mm)**] <**Insert dimension**>.
8. Acoustical Performance: Where sound-absorption requirement is indicated, fabricate interior liner panels with 1/8-inch- (3-mm-) diameter holes uniformly spaced approximately 1000 holes/sq. ft. (10 750 holes/sq. m).

    a. NRC of not less than [**0.65**] [**0.85**] [**1.00**] <**Insert rating**> when tested according to ASTM C 423.

2.8 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[**and factory-applied sealant**] in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal wall panels.

1. Finish: [**Match finish and color of metal wall panels**] [**As indicated on Drawings**].
2. Sealant: Factory applied within interlocking joint.

C. Flush-Profile Metal Soffit Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. AEP-Span.
    b. Architectural Building Components.
    c. ATAS International, Inc.
    d. Berridge Manufacturing Company.
    e. CENTRIA Architectural Systems.
    f. Copper Sales, Inc.
    g. Dimensional Metals, Inc.
    h. Englert, Inc.
    i. Fabral.
    j. Innovative Metals Company, Inc.
    k. MBCI; Div. of NCI Building Systems.
    l. McElroy Metal, Inc.
    m. Merchant & Evans Inc.
    n. Metal-Fab Manufacturing, L.L.C.

o. Metal Sales Manufacturing Corporation.
p. Petersen Aluminum Corporation.
q. Ultra Seam Incorporated.
r. <**Insert manufacturer's name**>.

3. Material: Same material, finish, and color as metal wall panels.
4. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum-zinc alloy-coated steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
   b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

   a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
   b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

7. Material: Copper sheet, [**16-oz./sq. ft. weight (0.55-mm thickness)**] [**20-oz./sq. ft. weight (0.68-mm thickness)**].

   a. Exterior Finish: [**Brushed satin (lacquered)**] [**Mirror polished**].

8. Panel Coverage: [**8 inches (203 mm)**] [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**20 inches (508 mm)**] <**Insert dimension**>.
9. Panel Height: [**0.875 inch (22 mm)**] [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] [**3.0 inches (76 mm)**] <**Insert dimension**>.
10. Sealant: Factory applied within interlocking joint.

D. Reveal-Joint-Profile Metal Soffit Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening**

ribs symmetrically spaced] [**flat pan**] between panel edges; with recessed reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. ATAS International, Inc.
    b. Cheney Flashing Company.
    c. Copper Sales, Inc.
    d. Merchant & Evans Inc.
    e. Metal Fab Manufacturing, LLC.
    f. Petersen Aluminum Corporation.
    g. <**Insert manufacturer's name**>.

3. Material: Same material, finish, and color as metal wall panels.
4. Material: Zinc-coated (galvanized) steel sheet, [**0.022-inch (0.56-mm)**] [**0.028-inch (0.71-mm)**] [**0.034-inch (0.86-mm)**] [**0.040-inch (1.02-mm)**] [**0.052-inch (1.32-mm)**] nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Aluminum sheet, [**0.032 inch (0.81 mm)**] [**0.040 inch (1.02 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

7. Panel Coverage: [**8 inches (203 mm)**] [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**20 inches (508 mm)**] <**Insert dimension**>.
8. Panel Height: [**0.75 inch (19 mm)**] [**1.0 inch (25 mm)**] [**1.5 inches (38 mm)**] <**Insert dimension**>.

E. V-Groove-Profile Metal Soffit Panels <**Insert drawing designation**>: [**Solid**] [**Perforated**] panels formed with vertical panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between panel edges; with V-groove joint between panels.

1. Manufacturers: Subject to compliance with requirements, [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

    a. ATAS International, Inc.
    b. Berridge Manufacturing Company.
    c. Dimensional Metals, Inc.
    d. Englert, Inc.
    e. Fabral.
    f. Innovative Metals Company, Inc.
    g. Petersen Aluminum Corporation.
    h. <**Insert manufacturer's name**>.

3. Material: Same material, finish, and color as metal wall panels.
4. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

5. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE fluoropolymer**] [**Siliconized polyester**] [**Plastisol**] <**Insert finish**>.
    b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

6. Material: Aluminum sheet, [**0.024 inch (0.65 mm)**] [**0.032 inch (0.81 mm)**] thick.

    a. Exterior Finish: [**2-coat fluoropolymer**] [**3-coat fluoropolymer**] [**4-coat fluoropolymer**] [**Mica fluoropolymer**] [**Metallic fluoropolymer**] [**FEVE**

fluoropolymer] [**Siliconized polyester**] [**Plastisol**] [**Clear anodized**] [**Color anodized**] <**Insert finish**>.**fluoropolymer**

b. Color: [**Match finish and color of metal wall panels**] [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

7. Panel Coverage: [**6 inches (152 mm)**] [**12 inches (305 mm)**] [**14 inches (356 mm)**] <**Insert dimension**>.
8. Panel Height: [**0.375 inch (10 mm)**] [**0.44 inch (11 mm)**] [**0.50 inch (13 mm)**] [**0.625 inch (16 mm)**] <**Insert dimension**>.

2.9 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.10 FABRICATION

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

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.11 GENERAL FINISH REQUIREMENTS

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

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

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

3.2 PREPARATION

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

1. Soffit Framing: Wire-tie[**or clip**] furring channels to supports[**, as required to comply with requirements for assemblies indicated**].

3.3 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Division 07 Section "Thermal Insulation."

1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Attach furring members to substrate with screws spaced 24 inches (610 mm) o.c.
2. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.

B. Blanket Insulation: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions and as follows:

1. Set vapor-retarder-faced insulation with vapor-retarder facing [**building exterior**] [**building interior**] [**as indicated on Drawings**]. Do not obstruct ventilation spaces, except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

3. Install insulation straight and true in one-piece lengths. Comply with the following installation method:

    a. Over-Framing Installation: Extend insulation over and perpendicular to top flange of framing members.

4. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with framing to hold insulation in place.

3.4 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of [**300 sq. ft. (27.8 sq. m.)**] <**Insert size**> in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
4. Install screw fasteners in predrilled holes.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install flashing and trim as metal wall panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
2. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
3. Copper Wall Panels: Use copper, stainless-steel or hardware-bronze fasteners.
4. Stainless-Steel Wall Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
7. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

G. Metal Liner Panels: Install panels on [**exterior side of girts with girts exposed to the interior**] [**interior side of girts with flush appearance on the inside**] [**girts as indicated on Drawings**].

H. Fire-Rated Metal Wall Panel Assemblies: Install metal liner panels on exterior side of girts, fastening through faces of panels, with girts exposed to the interior. Install subgirts horizontally, fastened to legs of metal liner panels. Install substrate board as indicated in Division 06 Section "Sheathing," in number of layers required for fire rating, over subgirts, attached with board fasteners. Install second set of subgirts horizontally, fastened through substrate board into first set of subgirts. Install exterior metal wall panels, fastened to second set of subgirts.

1. Comply with [**UL**] [**FMG**] requirements for fire-rated construction.

3.5 METAL SOFFIT PANEL INSTALLATION

A. In addition to complying with requirements of "Metal Wall Panel Installation, General" Article, install metal soffit panels to comply with the requirements of this article.

B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.7 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).

C. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.

E. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING AND PROTECTION

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

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Manufactured reglets.
2. Formed roof drainage system.
3. Formed low-slope roof flashing and trim.
4. Formed steep-slope roof flashing and trim.
5. Formed wall flashing and trim.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show layouts, profiles, shapes, seams, dimensions, and details for fastening, joining, supporting, and anchoring sheet metal flashing and trim.

C. Samples: For each type of sheet metal flashing and trim.

1.3 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 SHEET METALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. [2D] [2B] [3] [4] finish.

B. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

C. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
2. Blind Fasteners: High-strength stainless-steel rivets.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.4 REGLETS

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.

1. Manufacturers:

a. Cheney Flashing Company, Inc.
b. Fry Reglet Corporation.
c. Heckmann Building Products Inc.
d. Hickman, W. P. Company.

e. Keystone Flashing Company, Inc.
f. Sandell Manufacturing Company, Inc.

2. Material: Stainless steel, 0.0187 inch (0.5 mm) thick

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

D. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal, and in thickness not less than that of metal being secured.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide joint cover plates.

1. Fabricate scuppers from the following material:
   a. Stainless Steel: 0.0187 inch (0.5 mm)

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Fabricate copings from the following material:
   a. Stainless Steel: 0.0250 inch (0.65 mm) thick.

C. Base Flashing: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch (0.5 mm) thick.

D. Counterflashing and Flashing Receivers: Fabricate from the following material:
1. Stainless Steel: 0.0187 inch (0.5 mm) thick.

E. Roof-Penetration Flashing: Fabricate from the following material:
1. Lead: 4.0 lb/sq. ft. (1.6 mm thick) hard tempered.

F. Roof-Drain Flashing: Fabricate from the following material:
1. Stainless Steel: 0.0156 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints

of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

3.2 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch (600-mm) centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch (400-mm) centers.
2. Anchor interior leg of coping with screw fasteners and washers at 18-inch (450-mm) centers.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Secure in a waterproof manner. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.3 WALL FLASHING INSTALLATION

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

B. Reglets: Installation of reglets is specified in Division 3 Section "Cast-in-Place Concrete

C. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

END OF SECTION 076200

SECTION 078110 - APPLIED FIRE-RESISTIVE MATERIALS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the applied fire-resistive materials as shown on the drawings and/or specified herein, including but is not necessarily limited to the following:

1. Spray on fireproofing for structural steel and metal decking.
2. Seal coat over fireproofing in special areas.
3. Preparation of surfaces.
4. Field quality control.

1.3 RELATED SECTIONS

A. Structural steel – Section 051200.

B. Metal decking – Section 053100.

1.4 SUBMITTALS

A. Product Data: For each fire-resistive product specified.

B. Shop Drawings: Submit structural framing plans indicating the following:

1. Locations and types of surface preparations required before applying sprayed fire-resistive material.
2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:
    a. Applicable fire-resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
    b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

C. Product Certificates: Signed by manufacturer of sprayed fire-resistive material certifying that the products furnished comply with requirements.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. If primer is used on steel or metal deck, submit certifications by supplier of primer that primer is compatible with materials, and will not impair the required performance of the installed fireproofing. Such certification shall be accompanied by evidence that the primer was successfully used in conjunction with the fireproofing material in a UL test applicable to the construction.

1. Coordinate with Section 05120 – Structural Steel and 05300 – Metal Deck, prior to application of primer.

G. Product Test Reports: Indicate that physical properties of proposed sprayed fire-resistive materials comply with specified requirements based on comprehensive testing of current product formulations by a qualified testing and inspecting agency according to requirements specified in "Quality Assurance" Article.

H. Research/Evaluation Reports: Evidence of sprayed fire-resistive material's compliance with building code in effect for Project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed
fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Source Limitations: Obtain each type of sprayed fire-resistive material from one source and by a single manufacturer.

C. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR, Part 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

D. Mockups: After processing of initial submittals and before delivery and installation of fireproofing materials, prepare a sample installation of fireproofing work, approximately 100 sq. ft. in area; providing an example of each type required, applied on each different substrate, to produce each different rating as required and reasonably representative of entire sprayed on fireproofing work, for joint approval by representative of fire resistant material manufacturer and Owner. Work in other areas shall not proceed until mock-up has been completed. Mock-up work which remains in compliance with requirements and is in undamaged and acceptable condition may be retained as final work in place.

E. Material used in New York City must have BSA approval.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; shelf life, if applicable; and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, aboveground, so they are kept dry until ready for use. Remove from Project site and discard materials that have deteriorated.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperatures are 40 deg F. or lower, unless temporary protection and heat is provided to maintain temperatures at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material. Use natural means or, where this is inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.8 SEQUENCING

A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosures for interior applications to prevent deterioration of fire-resistive material due to exposure to unfavorable environmental conditions.

2. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.

3. Do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.

4. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.

5. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.

6. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, tested, and corrections have been made to defective applications.

1.9 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by Contractor and cosigned by Installer, agreeing to repair or replace sprayed fire-resistive materials that fail within the specified warranty period.

1. Failures include, but are not limited to, cracking, flaking, eroding in excess of specified requirements; peeling; and delaminating of sprayed fire-resistive materials from substrates due to defective materials and workmanship within the specified warranty period.

2. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

C. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated in this Article for material composition and physical properties representative of installed products.

B. Material Composition: As follows:

1. Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or Portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property listed as follows:

1. Dry Density: 15 lb./cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistive design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination."

2. Thickness: Provide minimum average thickness required for fire-resistive design shown on approved submittals.

    a. Fireproofing shall be of thicknesses and density to meet the requirements of the 2014 NYC Building Code for Type **1B** construction.

3. Bond Strength: 200 lbf/sq. ft. per ASTM E 736.

4. Compressive Strength: 5.21 lbf/sq. in. as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb./cu. ft.

5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

6. Deflection: No cracking, spalling, delamination, or the like per ASTM E 759.

7. Effect of Impact on Bonding: No cracking, spalling, delamination, or the like per ASTM E 760.

8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch, maximum dry density is 15 lb./cu. Ft., test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Flame Spread: 10 or less.
    b. Smoke Developed: 0.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

D. Products: Subject to compliance with requirements, provide products by one of the following:

1. Cementitious Sprayed Fire-Resistive Material

    a. Monokote Type MK-6; W.R. Grace & Co. - Conn., Construction Products Div.

2. Sprayed-Fiber Fire-Resistive Material

    a. Cafco Blaze-Shield II; Isolatek International Corp., Cafco Products.

2.2 EXPOSED SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For exposed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.

B. Cementitious Sprayed Fire-Resistive Material: Factory-mixed, dry, cement aggregate formulation, chloride-free formulation of gypsum or Portland cement binders, additives, and inorganic aggregates, mixed with water at Project site to form a slurry or mortar for conveyance and application, complying with the following requirements:

1. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination," but with an average density of not less than 22 lb./cu. ft.

2. Bond Strength: 1000 psf per ASTM E 736.

3. Compressive Strength: 10,000 psf. per ASTM E 761.

4. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

5. Deflection: No cracking, spalling, delamination, or the like per ASTM E 759.

6. Effect of Impact on Bonding: No cracking, spalling, delamination, or the like per ASTM E 760.

7. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. per ASTM E 859.

8. Combustion Characteristics: Passes ASTM E 136.

9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Flame Spread: 10 or less.
   b. Smoke Developed: 0.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

11. For exterior applications of sprayed fire-resistive material, provide manufacturer's formulation approved for surfaces exposed to the exterior.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Cement-Aggregate Cementitious Sprayed Fire-Resistive Material:

   a. Monokote Type Z106; W.R. Grace & Co.--Conn., Construction Products Div.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistive designs indicated.

B. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material, used where required by manufacturer to insure proper bond.

C. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistive designs indicated and fire-resistive product manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

D. Sealer for Sprayed Fire-Resistive: Transparent-drying, water-dispersible protective coating by manufacturer of sprayed-fiber fire-resistive material.

1. Product: Subject to compliance with requirements, provide "Cafco Bond-Seal" by Isolatek International Corp., Cafco Products or “Daraweld-C” by W.R. Grace.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, to determine whether they are in satisfactory condition to receive sprayed fire-resistive material. A substrate is in satisfactory condition if it complies with the following:

1. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive material with substrate under conditions of normal use or fire exposure.

2. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Do not proceed with installation of fire-resistive material until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances that could impair bond of fire-resistive material, including oil, grease, rolling compounds, incompatible primers, and loose mill scale.

B. For exposed applications, repair substrates to remove any surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

C. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintenance of adequate ambient conditions for temperature and ventilation.

3.3 INSTALLATION

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to convey and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by fire-resistive material manufacturer. Attach lathing accessories where indicated or required for secure attachment to substrate.

C. Coat substrates with adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by fire-resistive material manufacturer for material and application indicated.

D. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by fire-resistive material manufacturer, install body of fire-resistive covering in a single course.

E. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by manufacturer.

F. Where sealers are used, apply products that are tinted to differentiate them from the sprayed fire-resistive material over which they are applied.

G. Maintain ambient conditions during installation and for cure period following installation, as recommended by manufacturer. Provide ventilation and avoid excessive rate of drying.

H. Fireproofing to the underside of roof deck assemblies shall be done only after roofing application is complete and roof traffic has ceased.

I. No fireproofing shall be applied prior to completion of concrete work on steel decking.

J. Installation Sequence of Fireproofing

1. All tabs, hangers, supports, sleeves are to be installed by other trades prior to application of the fireproofing materials.

2. All ducts, piping, conduit, etc., shall be installed after the application of the sprayed fireproofing.

3. All patching and repairing of sprayed fireproofing, due to cutting by other trades or testing and inspection, shall be performed under this Section.

K. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation must be provided.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor to select a qualified independent testing and inspecting agency to perform field tests, inspections and prepare test reports at Owners expense.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing and inspecting of completed applications of sprayed fire-resistive material will take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of fire-resistive material for the next area until test results for previously completed applications of fire-resistive material show compliance with requirements.

1. Extent: For each 1000-sq. ft. area, or partial area, on each floor, testing and inspecting agency will evaluate the following characteristics. Tested values must equal or exceed values indicated and values required for approved
fire-resistance design.

a. Thickness for Floors, Roofs, and Walls: From the average of 10 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.
b. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
c. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination."

d. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: Cohesion and adhesion at frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 736.

2. When testing discovers applications of fire-resistive material not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

C. Remove and replace applications of fire-resistive material where test results indicate that they do not comply with specified requirements for cohesion and adhesion or for density, or both.

D. Apply additional fire-resistive material per manufacturer's written instructions where test results indicate that thickness does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Cure exposed sprayed fire-resistive material according to product manufacturer's written recommendations to prevent premature drying.

C. Protect fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at the time of Substantial Completion.

D. Coordinate application of fire-resistive material with other construction to minimize the need to cut or remove fire protection. As installation of other construction proceeds, inspect fire-resistive material and patch any damaged or removed areas.

E. Repair or replace work that has not been successfully protected.

END OF SECTION 078110

SECTION 078123 - INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes mastic and intumescent fire-resistive coatings.

B. Related Requirements:

1. Section 078100 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).
2. Section 099646 "Intumescent Painting" for intumescent paints that are fire retarding, but not fire resistive.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of fireproofing.

C. Evaluation Reports: For fireproofing, from ICC-ES.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup of each type of fireproofing and different substrate and each required finish as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is **50 deg F (10 deg C)** or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to **ASTM E 119 or UL 263** testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Mastic and Intumescent Fire-Resistive Coating <**Insert drawing designation or UL-design number**>: Manufacturer's standard, factory-mixed formulation and complying with indicated fire-resistance design.
1. Hilti Inc
2. PPG Paints
3. Sherwin Williams Company
4. Application: Designated for "exterior" "interior general purpose" and, "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
6. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

7. Hardness: Not less than 45, Type D durometer, according to ASTM D 2240.
8. Finish: As selected by Architect from manufacturer's standard finishes.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

I. Cure fireproofing according to fireproofing manufacturer's written instructions.

J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC**, Subsection 1705.14, "Mastic and Intumescent Fire-Resistant Coatings."**

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

SECTION 078410 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes through-penetration firestop systems for the following types of fire-resistance-rated assemblies:

1. Floors.
2. Roofs.
3. Walls and partitions.
4. Smoke barriers.

1.2 PERFORMANCE REQUIREMENTS

A. F-Ratings: Provide firestop systems with F-ratings equaling or exceeding fire-resistance rating of constructions penetrated as determined per ASTM E 814.

B. T-Ratings: Provide firestop systems with T-ratings required, as well as F-ratings, determined per ASTM E 814, where systems protect penetrating items with potential to contact adjacent materials in occupiable floor areas including, but not limited, to the following:

1. Penetrations located outside wall cavities.
2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

C. For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread indices of less than 25 and smoke-developed indices of less than 450, when tested per ASTM E 84.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include details of installation and design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

C. Product certificates.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide rated systems identical to those tested per ASTM E 814 and with products bearing the classification marking of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestop systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Through Penetration Firestop System Schedule at the end of Part 3.
1. DAP Inc.
2. Hilti Construction Chemicals, Inc.
3. Instant Firestop Mfg. Inc.
4. International Protective Coatings Corp.
5. 3M Fire Protection Products.
6. Tremco.
7. United States Gypsum Company.

2.2 FIRESTOP SYSTEMS

A. Compatibility: Provide firestop systems that are compatible with the substrates forming openings, and with the items, if any, penetrating firestop systems, under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Accessories: Provide accessories required to install fill materials that comply with requirements of tested assemblies, are approved by qualified testing and inspecting agency that performed testing, and are specified by manufacturer of tested assemblies. Accessories include, but are not limited to, the following:

1. Permanent forming/damming/backing materials.

a. Slag-/rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Clean openings immediately before installing firestop systems.

1. Remove foreign materials that could interfere with adhesion of firestop systems.
2. Remove laitance and form-release agents from concrete.
3. Produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.

C. Priming: Prime substrates when recommended in writing by firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not spill primers or allow them to migrate onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of firestopping with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove firestopping smears. Remove tape immediately after installation without disturbing firestopping seal.

E. Accessories: Install accessories of types required to support fill materials during their application and in the position necessary to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials, remove combustible forming materials and other accessories that are not permanent components of firestop systems.

F. Install fill materials for firestop systems by proven techniques.

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

G. Identification: Identify firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible. Include the following information on labels:

1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Firestop system manufacturer's name.
6. Installer's name.

H. Clean excess fill materials adjacent to openings as installation progresses by methods and with cleaning materials that are approved in writing by manufacturers and that do not damage materials in which openings occur.

3.2 FIELD QUALITY CONTROL

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

1. Notify Owner's inspecting agency at least seven days in advance of firestop system installations; confirm dates and times on days preceding each series of installations.

B. Do not cover up firestop system installations that will become concealed behind other construction until inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

C. Inspecting agency will state in each report whether inspected firestop systems comply with or deviate from requirements.

D. Enclosing firestop systems with other construction only after inspection reports are issued.

E. Where deficiencies are found, repair or replace firestop systems to comply with requirements.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to the alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Firestop Systems for Metallic Pipes, Conduit, or Tubing FS-2: Comply with the following:

1. UL-Classified Systems: WL-1056.

C. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing FS-3: Comply with the following:

1. UL-Classified Systems: WL-2075

D. Firestop Systems for Electrical Cables FS-4: Comply with the following:

1. UL-Classified Systems: WL-347

E. Firestop Systems for Cable Trays FS-4: Comply with the following:

1. UL-Classified Systems: WL-411

F. Firestop Systems for Insulated Pipes FS-5: Comply with the following:

1. UL-Classified Systems: WL-5026

G. Firestop Systems for Miscellaneous Mechanical Penetrations FS-6: Comply with the following:

1. UL-Classified Systems: WL7042

H. Firestop Systems for Groupings of Penetrations FS-7: Comply with the following:

1. UL-Classified Systems: WL-823

END OF SECTION 078410

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
2. Exterior joints in horizontal traffic surfaces.
3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.

B. See Division 8 Section "Glazing" for glazing sealants.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

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

1.3 SUBMITTALS

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

B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Preconstruction field test reports.

D. Compatibility and adhesion test reports.

E. Product certificates.

1.4 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates. Include joint sealant as part of exterior wall mock up.

1.5 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period. Warranty covers elastomeric joint selants.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period. Warranty covers elastomeric joint selants.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

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

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Silicone Sealant :

1. Available Products:
   a. Dow Corning Corporation; 790, 791, or 795.
   b. GE Silicones; SilPruf LM SCS2700.
   c. Tremco; Spectrem 1 or 3.
   d. Pecora Corporation; 864, 890, or 895.
   e. Polymeric Systems Inc.; PSI-641.
   f. Sonneborn, Division of ChemRex Inc.; Omniseal.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type O P, Grade NF.

B. Available Products:
   1. Bostik Findley; Chem-Calk 600.
   2. Pecora Corporation; AC-20+.
   3. Schnee-Morehead, Inc.; SM 8200.
   4. Sonneborn, Division of ChemRex Inc.; Sonolac.
   5. Tremco; Tremflex 834.

2.5 TRAFFIC GRADE SEALANT:

A. For Horizontal Joints: Two-part, self-leveling polyurethane sealant for traffic bearing construction; Mameco's Vulkem 255, Pecora's Urexpan NR-200, or Bostik's Chem-Calk 550.

B. For Horizontal Joints: One-part, self-leveling polyurethane sealant for traffic bearing construction; Mameco's Vulkem 45, Pecora's Urexpan NR-201, or Sika's Sikaflex-12SL.For Vertical Joints: One-part, non-sag polyurethane sealant; Mameco's Vulkem 116, Pecora's Dynatrol I, or Sika's Sikaflex 1a.

C. For Vertical Joints: Two-part, non-sag polyurethane sealant; Mameco's Vulkem 227, Pecora's Dynatrol II, or Bostik's Chem-Calk 500.

2.7 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Available Products:
   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
   b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.9 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
   a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

2. Remove laitance and form-release agents from concrete.
   a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

D. Joint surfaces to receive seal shall be sound, smooth, straight, parallel, clean, dry and free of all visible contaminants. Applications of non-visible coatings or contaminants to surfaces of joint interface area prior to installation of seal shall be controlled by the Architect/Engineer in consultation with the expansion joint manufacturer.

E. The joint configuration and the joint surfaces shall be as detailed in the drawings and in accordance with the contract specifications and in compliance with requirements in the current material Tech Data available from the Manufacturer. All known detrimental conditions shall be reported immediately in writing. Field measurements of the depth and width of the joint shall be supplied to manufacturer before material is ordered.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

G. Installation of Preformed Silicone-Sealant System: Comply with manufacturer's written instructions.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

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

J. Do not proceed with the installation of joint sealer if the joint is other than designed, until written notification of these conditions is submitted to the manufacturer and design professional, and a written acknowledgement with an order to proceed is provided.

K. Do not proceed with the installation of joint sealer under adverse weather conditions when joint to be sealed is damp, wet or frozen, or when temperatures are below or above the manufacturer's recommended limitations for installation. Consult manufacturer for specific instructions before proceeding.

L. Joint sealer/expansion joint material to be installed in strict accordance with the manufacturer's instructions and the advice of their official representative.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
3. Division 08 Section "Door Hardware".
4. Division 08 Section "Access Control Hardware".
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
2. ANSI A250.8 – Recommended Specifications for Standard Steel Doors and Frames.
3. ANSI/NAAMM HMMA 801 - Glossary of Terms for Hollow Metal Doors and Frames.
4. NAAMM HMMA 802 - Manufacturing of Hollow Metal Doors and Frames.
5. NAAMM HMMA 803 - Steel Tables.
6. NAAMM HMMA 810 - Hollow Metal Doors.
7. NAAMM HMMA 810 TN01 - Defining Undercuts.
8. NAAMM HMMA 820 - Hollow Metal Frames.
9. NAAMM HMMA 820 TN01 - Grouting Hollow Metal Frames.
10. NAAMM HMMA 820 TN02 - Continuously Welded Frames.
11. NAAMM HMMA 831 - Recommended Hardware Locations for Hollow Metal Doors and Frames.

12. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames.
13. ANSI/NAAMM HMMA 841 – Tolerances and Clearances for Commercial Hollow Metal Doors and Frames.
14. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
15. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
16. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
17. ANSI/BHMA A156.15 - Hardware Preparation in Steel Doors and Frames.
18. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
19. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
20. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
21. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
22. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: Meet fabrication and quality standards set by the Hollow Metal Manufacturers Association, HMMA, as set forth in the contract documents and NAAMM HMMA standards 800 through 860 series.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

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

1.6 COORDINATION

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

1.7 WARRANTY

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

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products.
2. Curries Company.
3. Fleming.

2.2 MATERIALS

A. Metallic-Coated Steel Sheet: tension level steel to ASTM A924, galvanized to ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating known commercially as paintable Galvanneal.

B. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI A250.8.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Edges, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 10 gauge plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
7. Hardware Reinforcements: Fabricate according to ANSI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical performance level:

1. Design: Flush panel.

2. Core Construction: Honeycomb - Structural small cell (1" (25.4mm) maximum) kraft paper. Weight: 80 lb. (36.3kg) per ream minimum. Density: 1.03 pcf (16.5kg/m^3) minimum, sanded to the required thickness.
3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 1.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 10 gauge plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Fleming D Series.
2. Fleming Temperature Rise: D Series.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames, with the exception of knock down types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
4. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 12 gauge (0.081-inch -2.7-mm) thick steel sheet.
5. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
6. Manufacturers Basis of Design:

    a. Fleming F Series/F Series SR.

C. Interior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A40.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

4. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.]
5. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.]
6. Frames for Wood Doors: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
7. Frames for Borrowed Lights: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
8. Manufacturers Basis of Design:

    a. Fleming DW/DW CO/DW SR Series (Drywall Profile).
    b. Fleming F Series/F Series SR (Masonry Profile).

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A40 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engauge stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A40 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 HOLLOW METAL PANELS

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

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.

1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM 841.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
6. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
8. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
10. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

11. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Remove weld slag and spatter from exposed surfaces. All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth and uniform surfaces. On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up primer. Primer shall be fully cured prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with NAAMM/HMMA 840 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and

replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 082100 - WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.

B. Related Sections:

1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples: For wood-veneer doors.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated." and WDMA I.S.1-A, "Architectural Wood Flush Doors."

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products the following:

1. Mohawk Flush Doors, Inc.; a Masonite company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: Janitor's closets, exits, and where indicated.
3. Standard Duty: Closets (not including janitor's closets) and where indicated.

C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

E. Solid-Core Doors:

1. Locations: Apartment Bathrooms / Bedrooms / Closets

2.3 DOORS FOR OPAQUE FINISH

A. Solid-Core Doors:

1. Compatibility of grain and color between veneer and lumber.

2. Type 1 Glue (PVA-waterproof).

3. Joints: Doweled and glued under pressure.

4. Stiles, rails and mullions shall be veneered construction using edge glued core material of particle board or lumber with face veneer of 1/8" minimum thickness before sanding. Exposed edges shall be same species as face.

5. Solid Panels: Mitered rim, tongue and grooved into edge of flush panel. Miters shall be reinforced with splines. Panel face slip matched veneers. Panel edge concealed by solid sticking bead or applied moldings. Panel thickness 1/2" within a 1-3/4" thick door. Design of panel arrangements to match existing stile and rail doors.

a. Panel core shall be particle board or staved lumber core per fabricator's standard.

6. Sanding: Machine sanded with not less than 120 grit, no cross grain scratches permitted. Each door hand sanded with orbital sander.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2.5 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section “Painting". Seal all four edges, edges of cutouts, and mortises with primer.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

END OF SECTION 082100

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes wall and ceiling access doors and filtered louvered access doors and frames for ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of access door and frame indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material in specified finish.

D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

1.4 COORDINATION

A. If retaining this Article, also retain "Schedule" Paragraph in "Submittals" Article.

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

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Drywall Beads: 0.0299-inch zinc-coated steel sheet to receive joint compound.

C. Manufacturer's standard finish.

D. Touch latches for all access panels

2.2 ALUMINUM MATERIALS

A. Aluminum Sheet: ASTM B 209.

1. Mill finish.
2. Baked-Enamel Finish: Manufacturer's standard.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturer: Subject to compliance with requirements, provide products by the following:

1. Access Panel Solutions

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel or metallic-coated steel sheet.

1. Locations: Ceiling.
2. Door: Minimum 0.060-inch- thick sheet metal.
3. Type: taped in
4. Frame: Minimum 0.060-inch- thick sheet metal with 1-1/4-inch- wide, surface-mounted trim.
5. Hinges: Continuous piano.
6. Latch: Cam latch with interior release.
7. Lock: Cylinder.

a. Lock Preparation: Division 08 Section "Finish Hardware (Scheduled by Describing Products)]."

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 085300 - UPVC WINDOWS

1. GENERAL

1.1. Section Includes

A. Steel Reinforced Polymer windows.

B. Configurations of windows required: fixed, in-swing casement, Window Wall.

1.2. References

A. Publications listed below are part of this specification to the extent they are referenced. When publications are cited in these specifications by use of shortened names or by standard number alone, it must be understood that reference is made to the full publication and edition as listed here.

B. AAMA/WDMA/CSA 101/I.S.2/A440-08/12: North American Fenestration Standard/Specification for windows, doors, and skylights (use appropriate specifications depending on certification for each product type).

C. NFRC: National Fenestration Rating:

D. 100: Procedure for Determining Fenestration Product U-Factors

E. 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

F. 500: Procedure for Determining Fenestration Product Condensation Resistance Values

G. E 90-09: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

H. E 413: Classification for Rating Sound Insulation

I. E 1332: Standard Classification for Rating Outdoor-Indoor Sound Attenuation

J. E 2235-04 (2012): Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods

K. E 2190: Standard Specification for Insulating Glass Unit Performance Evaluation.

L. ANSI Z97.1-2015, CPSC 16 CRF 1201 (1977), & CAN/CGSB 12.1-M90 (1990)

M. City of New York Department of Health Window Falls Prevention Program, Chapter 12-11, Specifications for Window Guards for Other Than Double Hung Windows

N. American Society of Civil Engineers: ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 2010

1.3. Performance Requirements for CW class windows:

A. Windows shall meet or exceed 2009 IECC Requirements and Energy Star Design Requirements (Certified Homes Version 3.1 for Sites 01 - 06 and Multi-Family New Construction Version 1.1 for Site 07).

B. Windows shall meet a rating of CW – DP 65/70 specifications in accordance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08/12.

C. Window Air Leakage, ASTM E 283: Window air leakage when tested at Fixed: 6.27 psf, Operable: 1.57 psf shall be Fixed: 0.06 cfm/ft2, Operable: 0.10 cfm/ft2, or less.

D. Window Water Penetration, ASTM E 547 and ASTM E 331: No water penetration through window when tested under static pressure of Fixed: 12.11 psf, Operable: 12.11 psf.

E. Thermal Performance: Windows must be tested in accordance with the NFRC standards. Windows must comply with NFRC requirements. The windows, including glass and Polymer framing, shall have a thermal transmittance of:

1. U-factor (Btu/hr/ft2/°F): Fixed: As Shown on the Drawings
   Operable: As Shown on the Drawings
2. SHGC: Fixed: As Shown on the Drawings
   Operable: As Shown on the Drawings

3. VT: Fixed: As Shown on the Drawings
   Operable: As Shown on the Drawings

1.4. Thermal Movement

A. Allow for thermal movement of the window based on site mean temperature +/- 70 F, window/element size and coefficient of linear expansion of Polymer.

1. Non-white windows, allow for thermal movement of the window based on solar-heat absorption.

1.5. Acoustical Performance

A. Windows shall meet or exceed requirements of OITC, when tested in accordance to ASTM E
1332; or STC, when tested according to ASTM E 90. The windows, including glass and Polymer framing, shall have an acoustical performance of:

1. Fixed window:
   STC: As Shown on the Drawings,
   OITC: As Shown on the Drawings
2. Operable windows:
   STC: As Shown on the Drawings,
   OITC: As Shown on the Drawings

1.6. Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays. Review and coordinate access for material hoisting, storage and distribution.
2. Review, discuss, and coordinate the interrelationship of windows and window wall with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting materials and finishes.
3. Review and coordinate details for adjoining and abutting systems.
4. Review and discuss the sequence of work required to construct a watertight and weather-tight exterior building envelope.
5. Inspect and discuss the condition and coordination of substrate and other preparatory work.

1.7 Submittals

A. Product Data: For each type of product.

1. Include construction full scaled details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings

1. Include plans, elevations, sections, full scaled details, hardware, accessories, insect screens (if required), operational clearances, and details of installation, including anchor, head, jamb, sill installation details, flashing, and sealant installation prior to fabrication.
2. Identify size, type, spacing and locations as well as adjacent substrates, when applicable, of assembly and attachment fasteners, spacers, isolators, setting blocks, glazing sealants and gaskets.

C. Delegated-Design Submittal: For anchorage of windows, indicated to comply with performance requirements and design criteria, including shop drawings and analysis

data signed and sealed by the qualified Professional Engineer that is registered in the State of New York and who is responsible for their preparation.

1. Include calculations for the anchorage to structure, including deflections, in- place stresses, negative pull-off loads and capacity of fasteners, signed and sealed by a Professional Engineer registered in the State of New York.

D. Samples: For polymer windows and components required, prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches and 12 inches long by full profile of molded or extruded items
2. Exposed Hardware: Include Samples of hardware and accessories involving color or profile selection.

E. Product Schedule: For windows. Use same designations as indicated on Drawings.

A. Qualification Data: For manufacturer and Installer, including history of similar projects completed within the last 5 years.

B. Product Test Reports: For each type of window, for tests performed by a qualified and accredited testing agency.

C. Thermal performance calculations.

D. Field quality-control reports.

E. Maintenance Manuals: Provide five copies of a bound illustrated maintenance manual including a description of procedures for replacement of glass, gaskets, hardware and sealants as well as a list of unit prices for replacement hardware, gaskets, sealants IGU's and any other components that may be required to perform emergency repairs or replacements.

F. Sample Warranties: For each manufacturer warranty specified.

1.8 Quality Assurance

A. Manufacturer Qualifications: A manufacturer capable of fabricating polymer windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to window manufacturer for installation of units required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. U-factor, SHGC, Visible Transmittance (VT), and air leakage rate for manufactured fenestration products shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council.

1. Manufactured fenestration products shall have a permanent nameplate, installed by the manufacturer, listing the U-factor, SHGC, air leakage rate, and where required, Visible Transmittance (VT).
2. When the fenestration product does not have such nameplate, the installer or supplier of such fenestration shall provide a signed and dated certification for the installed fenestration listing the U-factor, SHGC, and the air leakage rate.

1.9 Quality Control

A. Refer to Article 3.3 Field Quality Control.

1.10. Delivery

A. A temporary covering shall protect exposed surfaces after completing fabrication of products.

B. Deliver in manufacturer's original packaging with labels intact.

1.11. Storage and Handling

A. Products are heavy and fragile. Special care, sufficient manpower, tools, and equipment shall be used for unloading, transporting, warehousing, and installing the products. Two forklifts should be used to unload container on job site.
B. Industrial straps (at least 5,000 lbs.) MUST be used to unload large pallets.
C. Store window units in an upright position in a clean and dry storage area above ground to protect from weather.
D. Cover materials with tarpaulins or plastic hung on frames to provide air circulation and prevent contaminants from contacting polymer.
E. Remove all paper type wrappings and interleaving that are wet or which could become wet when unloading materials.
F. Glass must never be stored or transported in a horizontal/flat orientation.
G. Store crated glass in a cool, dry, and well-ventilated area where it will not be subject to rain or direct sun.
H. Minimize handling by scheduling shipments by floors and by initially locating crated products as close to their installation as possible.
I. Use mechanized window handling and installation equipment with vacuum suction cups for windows heavier than 150 lbs.
J. For a more information about storage and handling windows, refer to the complete and current instructions are available at https://www.intuswindows.com/support-documents/

1.12. Windows warranty:

A. The products supplied by Seller shall be free from material defects, in material and workmanship, for a period of five (5) from the date of substantial completion of the project.
B. Clear insulating glass with stainless steel or warm edge spacers is warranted against seal failure resulting in visible obstruction through the glass for five (5) years from the date of Substantial Completion under the normal use conditions. Glass is warranted against stress cracks caused by manufacturing defects for one (1) year from Substantial Completion.
C. The laminated glass is warranted to be free of defects in materials and workmanship for products which use PVB interlayer which are warranted for a period of five (5) years, from the date of Substantial Completion.
D. The polymer white profiles without laminate will resist cracking, peeling, chalking, blistering, flaking, and significant ultraviolet discoloration (greater than 6 Delta E) caused by natural environmental atmospheric conditions for the period of five (5) years from the date of Substantial Completion.
E. The polymer laminated exterior finishes (using Renolit EXOFOL FX films) will resist cracking, peeling, chalking, delaminating, blistering, flaking, and significant ultraviolet discoloration (greater than 6 Delta E) caused by natural environmental atmospheric conditions for the period of ten (10) years.
F. Non-glass components are warranted to be free from manufacturing defects for two (2) years

from the date of Substantial Completion.

2. PRODUCTS

2.1. Manufacturer

1. Wythe Windows
   Contact: Darren Macri: 201.962.7444 50 Spring Street, Ramsey, NJ 07446
2. Intus Windows
   Contact: Connor McGorty: 203.615.4330
3. Rehau Windows

2.2. Materials

A. Window system: Varick Windows.
B. Minimum Outside Nominal Wall Thickness:
   1. Primary frame and sash extrusions exterior walls: 0.106” (2.7mm)
   2. Secondary extrusions (e.g. glazing stops and closures): 0.059” (1.5mm)
C. Face dimensions (nominal): as indicated on Architectural Drawings.
D. The frames feature accessory grooves which allow for snap-in attachment of Polymer nailing
   flange, trim profile(s) and mulled window joint covers.
E. Window Sash and Frame shall be configured to receive glazing beads (stops) that snap into
   the interior side of the insulating glass.
F. Reinforcement:
   1. S teel shall be in size, configuration, and location within the window as indicated in the test reports and Wythe Windows instructions.
G. Weather seals:
   1. Co-extruded polymer replaceable weather seals:
      a. Shapes, designs, and thickness as needed to satisfy performance requirements
      b. Standard color: black
H. Glass:
   1. Glass shall comply with requirements of AAMA/WDMA/CSA 101.I.S.2/A440-05, Section 10.2.
   2. Insulating glass panels shall have an overall nominal thickness of 0.94” (24mm) – 1.575” (40mm). Thickness as indicated on Drawings.
   3. Glazing type: annealed or tempered, as Indicated on Drawings.
   4. Glass type: clear, low-e, ceramic coated, as Indicated on Drawings.
   6. Spacer: Warm edge spacer

2.3. Hardware

A. Provide manufacturer’s standard single handle inswing casement multi-point locking system. Locking points interact with a manually operated handle to bring window sashes into a turn or a tilt position.
B. Standard hardware is used for securing window sashes and to position them in different ventilation positions. Normally it is necessary to overcome the counter force of a seal when closing. Any other type of usage is not in accordance with the intended application. Windows for special applications (i.e. burglar-resistance or for installation in humid conditions / in environments with corrosive atmospheric substances) require special fittings with separately agreed performance criteria, designed for the application.
C. Handle: Provide standard handle. Standard Colors: Architect to Select from manufacturer options.

D. Limiters: 4″ limiter with friction.

2.4. Fasteners

A. Exposed fasteners shall be selected to prevent galvanic reaction with any reinforcement materials fastened.

B. Above criteria is applicable to screws used to secure internal reinforcement and to fasteners used in window mulling connections, if required.

C. Avoid exposed fasteners to greatest extent possible.

D. Where exposed fasteners are unavoidable in finished surfaces, use flathead countersunk Phillips head screws.

E. Installation anchors must be approved by the responsible engineer/architect for the project.

2.5 Not Used

2.6. Installation Accessories:

A. Mounting brackets and screws

2.7 Slab Edge Cover

A. At Window Wall locations and as indicated on Drawings.

B. Material: Extruded Aluminum

C. Finish: Standard: Kynar 50%, Custom color

D. Color: to match the exterior window frame finish.

E. Coordinate with adjacent materials and finishes, and insulation as required per Drawings.

2.8. Finish

A. Application of laminated color foils shall be performed per manufacturer's specifications.

B. All exterior laminates shall be RENOLIT FX grade or approved equal.

C. The laminated surface shall be uniform and free from streaks, blisters, sags, or other surface imperfections

D. Standard Colors: Architect to select from manufacturer available colors (non-white).

E. Protection:

1. Provide film to protect exposed finished surfaces during shipment, storage, and installation whenever possible
2. Film shall not affect factory finish after finished component is installed and film is stripped, no residue, adhesive, or film covering, visual non-uniformity or other deleterious effects or substances shall remain on surfaces
3. Factory applied protective film must be removed immediately after installation
4. When cleaning agents/paint etc. are applied to the building the windows must be Protected.

3. Execution

3.1. Examination

A. Site Verification of Conditions: Before installation, examine window openings and adjacent building structure where windows will be applied for conditions that will prevent proper execution of this portion of Work and endanger permanency. Do not proceed with installation

until defects have been corrected.
B. Verify sealant compatibility and adhesion to Polymer in conjunction with sealant manufacturer.
C. Acceptance of Condition: Beginning installation confirms acceptance of existing conditions.

3.2. Installation

A. General Requirements:
B. Comply with manufacturer's instruction and recommendations for installation of work.
C. Do not erect warped, bowed, deformed, or otherwise damaged or defaced members. Replace materials that are damaged during installation as directed.
D. Set units' level, plumb, and true to line, with uniform joints. Support units on shims and secure in place by approved installation anchors/fasteners that properly engage into supporting structure.
E. Insulation must be used around the perimeter of the window in accordance with shop drawings and the insulation manufacturer's guidelines. Insulation must allow for expansion and contraction of the installed window.
F. Flashing and other materials used around window opening shall be corrosion-resistant, non-staining, non-bleeding, and compatible with adjoining materials.
G. Erection Tolerances:
    1. Variations from Plumb: +/- 1/8" maximum in window height
    2. Variations from Level: +/- 1/8" maximum in 10' run, non-cumulative

3.3. Field Quality Control

A. Field Check for Water Leakage:
    1. Newly installed fenestration product(s) shall be field tested in accordance with AAMA 502-12, "Voluntary Specification for Field Testing of Newly Installed Fenestration Products."
    2. AAMA 502-12 test shall be performed during construction, prior to an issuance of the building occupancy permit, but no later than six months after installation of the fenestration products.
    3. Architect will determine the quantity and type(s) of window(s) to be tested. At minimum, test two of each of the following types: fixed, casement, casement w/ PTAC, and window wall w/ casement and PTAC.
    4. In case of water penetration take corrective action and re-test as necessary until the problem is resolved.
    5. Default field test conditions are not the same as NAFS requirements for lab testing.
    6. Unless otherwise specified, water test shall be conducted at a static test pressure equal or less to 2/3 of the tested and rated laboratory performance per AAMA/WDMA/CSA 101/I.S. 2/A440.
    7. CW class windows shall be tested to a complete four-cycle water penetration resistance test in accordance with ASTM E547. Each complete cycle shall consist of 5 minutes with the pressure applied and 1 minute with the pressure released, during which the water spray is continuously applied. The total test duration shall be a minimum of 24 minutes.
    8. Unless otherwise specified the air test shall be conducted at 1.5 times of the tested and rated laboratory performance per AAMA/WDMA/CSA 101/I.S. 2/A440. Or minimum window performance grade rating as per AAMA/WDMA/CSA 101/I.S. 2/A440.

3.4. Adjusting

A. Weather seal contact shall be checked, and any required final hardware adjustment made for proper operation and performance of units.

B. Adjustments/maintenance should be made at least once per year.

3.5. Cleaning

A. Remove visible labels and adhesive residue according to manufacturer's instruction.

B. Clean completed system in compliance with manufacturer's recommendations, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and joint sealants, dirt, and other substances from finished surfaces promptly after erection.

C. Remove protective material from prefinished surfaces.

D. Wash down exposed surfaces using a solution of mild detergent in warm water applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.6. Protection

A. Institute protective measures and other precautions needed to assure Work will be without damage or deterioration, other than normal weathering, at time of acceptance.

B. Protect windows from damage by chemicals, solvents, paint or other construction operations that may cause damage.

END OF SECTION 085300

SECTION 085413 - FIBERGLASS WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass windows.

1.2 RELATED SECTIONS

A. Section 07 27 00 - Air Barriers: Water-resistant barrier.

B. Section 07 92 00 - Joint Sealants: Sealants and caulking.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
   2. AAMA 624-10 - Voluntary Performance Requirements and Test Procedures for Organic Coatings on Fiber Reinforced Thermoset Profiles.

B. American Society for Testing and Materials (ASTM):
   1. ASTM C 1036 - Flat Glass.
   2. ASTM C 1048 - Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
   3. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
   4. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   5. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
   6. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   7. ASTM F 2090 – Standard Specification for Window Fall Prevention Devices With Emergency Escape (Egress) Release Mechanisms

C. Window and Door Manufacturers Association (WDMA):
   1. ANSI/AAMA/NWWDA 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

D. Screen Manufacturers Association (SMA):
   1. SMA 1201 – Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors.

E. Window and Door Manufacturers Association (WDMA):
   1. AAMA/WDMA/CSA 101/I.S.2/A440 – North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

1.4 PERFORMANCE REQUIREMENTS

A. Windows shall meet a rating of LC–PG [_____] specifications in accordance with ANSI/AAMA/WWDMA 101/I.S.2/A440-17.

B. Window Air Leakage, ASTM E 283: Window air leakage when tested at 1.57 psf (25 mph) shall be 0.05 cfm/ft^2 of frame or less.

C. Window Water Penetration, ASTM E 547: No water penetration through window when tested under static pressure of 7.5 psf (42 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.

D. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.

1.6 QUALITY ASSURANCE

A. Mockup:
1. Provide sample installation for field testing window performance requirements and to determine acceptability of window installation methods.
2. Approved mockup shall represent minimum quality required for the Work.
3. Approved mockup shall remain in place within the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.

B. Storage:
1. Store materials in accordance with manufacturer's instructions.
2. Store materials off ground and under cover.
3. Protect materials from weather, direct sunlight, and construction activities.

C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Pella Corporation
102 Main Street Pella, Iowa 50219.
Phone (641) 621-1000.
Website www.pella.com.

B. Fibertech Window and Door Manufacturing Corp
25-27 Kodiak Crescent
North York Ontario M3J 3E5

888.232.4956
www.fibertec.com

2.2 FIBERGLASS WINDOWS

A. Windows: Pella Impervia.
1. Factory-assembled fiberglass [casement and awning windows with outward-opening sash installed in frame] [hung windows with interior tilting sash] [sliding window] [fixed sash and frame unit] [fixed frame direct set].
2. Frame and Sash Material: 5-layer, pultruded-fiberglass material, reinforced with interlocking mat.

B. Frame:
1. Type: [Block frame] [Integral Nail Fin].
2. Interior and Exterior Frame: Pultruded, fiberglass composite [with foam inserts].
3. Overall Frame Depth: [3-1/4] [3] inches.
4. Nominal Wall Thickness of Fiberglass Members: 0.050 inch to 0.090 inch.
5. Frame Corners:
   a. Mitered.
   b. Joined and bonded with Neutral-cure Room Temperature Vulcanizing silicone hot-melt adhesive, with corner lock.
6. Jambs: Contain factory-drilled installation screw holes.

C. Sash:
1. Sash Corners:
   a. Mitered.
   b. Bonded and sealed with injected Neutral-cure Room Temperature Vulcanizing silicone hot-melt adhesive.

D. Glazing:
1. Float Glass: ASTM C 1036, Quality 1.

   a. Tempered Glass: ASTM C 1048.

2. Type: Polyurethane reactive (PUR) hot-melt glazed, 11/16-inch thick, insulating glass, [clear [tempered]] [multi-layer Low-E coated with argon [tempered]] [obscure tempered].

2.3 OPTIONS

A. Insect Screens:
1. Compliance: ASTM D 3656 and SMA 1201.
2. Screen Cloth: [Black Vinyl-coated fiberglass, 18/16 mesh] [Vinyl-coated 18/18 mesh].
3. Set in aluminum frame.
4. Complete with necessary hardware.
5. Screen Frame Finish: Baked enamel.
   a. Color: [Black].

2.4 HARDWARE

A. Casement and Awning:

1. Easy-Slide Operator Assembly
   a. Hardened nickel-coated Steel worm and wheel gears, 5 ball bearings.
   b. Operator Base: Zinc-magnesium alloy hub and gearbox housing with a corrosion-protecting

ultra-clear finish.
c. Operator Linkage, Stainless steel swing arm and hinge pin for extra corrosion protection of exposed components: 300 series stainless steel.
d. Kevlar-reinforced drive belt.
e. External Hardware Salt Spray Exposure, ASTM B 117: Exceed 1,000 hours.
f. Optional Easy-Slide operator with Accessibility Lock Lever assembly
1) 6 inch elongated lock lever.
2) 5lb operational forces available on sizes when frame width is less than or equal to 35 inches and frame height is less than or equal to 72.5 inches or frame width is greater than 35 inches but less than or equal to 36 inches and frame height is less than or equal to 60 inches.

3. Handle Finish
a. Integrated Folding Crank: [Baked enamel, [White]].

4. Locking System: Multi-lock System.
a. Single-handle locking system.
b. Operate positive-acting arms that reach out and pull sash into locked position.

5. Casement Windows: One installed on sash 27.5 inches and smaller in frame height, 2 unison operating locks installed on sash over 27.5 inches in frame height and 3 unison operating locks installed on sash over 72.15 inches in frame height.

6. Lock Handle Finish: [Baked enamel, [White]].

B. Hung

1. Balances: Galvanized steel block-and-tackle balances.

2. Lock:
a. Type: Self-aligning, cam-action lock.
b. Windows 37 Inches Wide or Greater: 2 locks.
c. Finish: [Match window interior finish] [satin nickel] [bright brass] [oil-rubbed bronze].

3. Tilt Latches:
a. Glass reinforced Nylon 6
b. Integrated into sash corner
c. Finish is matte gray

4. Lower Sash Lift: Integrated into checkrail.

C. Sliding Window

1. Balances: Galvanized steel block-and-tackle balances.

2. Lock:
a. Type: Self-aligning, cam-action lock.
b. Windows 37 Inches High or Greater: 2 locks.
c. Finish: [Match window interior finish] [satin nickel] [bright brass] [oil-rubbed bronze].

2.5 TOLERANCES

A. Windows shall accommodate the following opening tolerances:
1. Vertical Dimensions Between High and Low Points: Plus 1/4-inch, minus 0 inch.

2. Width Dimensions: Plus 1/4-inch, minus 0 inch.
3. Building Columns or Masonry Openings: Plus or minus 1/4-inch from plumb.

2.6 FINISH

A. Exterior and Interior Finish: Factory-applied powder-coat paint, comply with AAMA 624-10.

1. Dual-color: [[Black]] exterior with White interior.

2.7 INSTALLATION ACCESSORIES

A. Flashing/Sealant Tape
1. Aluminum-foil-backed butyl window and door flashing tape.
2. Maximum Total Thickness: 0.013 inch.
3. UV resistant.
4. Verify sealant compatibility with sealant manufacturer.

B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.

C. Exterior Perimeter Sealant: “Pella Window and Door Installation Sealant” or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

D. Block Frame Installation Accessories: [Installation clips]

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Install windows to be weather-tight.

C. Maintain alignment with adjacent work.

D. Secure assembly to framed openings, plumb and square, without distortion.

E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating foam sealant.

F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

3.3 FIELD QUALITY CONTROL

A. Field Testing: Field water testing shall be conducted in accordance with ASTM E1105 Test Procedure B. The test pressure shall be based on the maximum positive components and cladding design pressure. Utilizing the AAMA 502 field test reduction, the water test pressure is 10% of the maximum positive design pressure.

3.4 CLEANING

A. Clean window frames and glass in accordance with Division 1 requirements.

B. Do not use harsh cleaning materials or methods that would damage finish or glass.

C. Remove labels and visible markings.

3.5 PROTECTION

A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 06 Section “Rough Carpentry”.
2. Division 06 Section “Finish Carpentry”.
3. Division 08 Section “Door Hardware Schedule”.
4. Division 08 Section “Hollow Metal Doors and Frames”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware

Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Twenty five years for manual surface door closer bodies.
3. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
    a. Yale Hardware
    b. Omnia Hardware
    5 Cliffside Drive
    PO Box 330
    Cedar Grove NJ 07009
    973.239.7282
    www.OmniaIndustries.com

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in

Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

    a. Two Hinges: For doors with heights up to 60 inches.
    b. Three Hinges: For doors with heights 61 to 90 inches.
    c. Four Hinges: For doors with heights 91 to 120 inches.
    d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

    a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
    b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

    a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

    a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Acceptable Manufacturers:

    a. Bommer Industries (BO).
    b. Hager Companies (HA).
    c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

B. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.

1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.

2. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.

3. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.

4. Acceptable Manufacturers:

    a. Hager Companies (HA).
    b. Johnson Hardware (JO).
    c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Acceptable Manufacturers:

    a. Door Controls International (DC).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Acceptable Manufacturers:

    a. Door Controls International (DC).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.

3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Acceptable Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer’s Standard.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer’s United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.

1. Acceptable Manufacturers:

    a. Medeco (MC) - X4 Series.
    b. Sargent Manufacturing (SA) - XC Series.

F. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

G. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

H. Construction Keying: Provide temporary keyed construction cores.

I. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

J. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) – ML2000 Series.
b. Sargent Manufacturing (SA) – 8200 Series.
c. Yale Locks and Hardware (YA) – 8800FL Series.

B. Tubular Locksets:

1. Standard tubular locksets designed to fit ANSI standard 161 door prep without additional through-bolt preps.

2. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU) - TL3700 Series.
    b. Sargent Manufacturing (SA) – DL Series.
    c. Yale Locks and Hardware (YA) - RL Series.

2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.7 ELECTRIC STRIKES

A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Acceptable Manufacturers:

    a. Folger Adam EDC (FO).
    b. HES (HS).
    c. Security Door Controls (SD).

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the

Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.

1. Acceptable Manufacturers:

    a. Dorma Products (DO) - 9000 Series.
    b. Hager (HA) – 4500 Series.
    c. Yale Locks and Hardware (YA) - 6000 Series.

2.9 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) – DC6000 Series.
b. Sargent Manufacturing (SA) - 351 Series.
c. Norton Door Controls (NO) - 7500 Series.
d. Yale Locks and Hardware (YA) - 4400 Series.

C. Apartment Door Closers: Full Mortise Closer Hinges (Spring Loaded)

1. Acceptable Manufacturers:

a. Waterson - K51M Series.
1) 4.5 x 4.5 inches
2) Material: stainless steel
3) Hinge Sets: three / door
4) Corners: square
5) Finish: satin stainless steel

2.10 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

a. Hiawatha, Inc. (HI).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

a. Rixson Door Controls (RF).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Sargent Manufacturing (SA).

2.11 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Manufacturer’s Abbreviations:
   1. MK - McKinney
   2. PE – Pemko
   2a OM - Omnia
   3. RF - Rixson
   4. RO - Rockwood
   5. YA - Yale
   6. MC - Medeco
   7. HS - HES
   8. NO - Norton
   9. SU - Securitron
   10. SA - Sargent

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.

1.2 DEFINITIONS

A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

E. Two-ply Laminated Glass: Two sheets of monolithic glass bonded together with a plastic interlayer by heat and pressure.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and

installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Specified Design Wind Loads: 40psf.

b. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

1) Basic Wind Speed: 110 mph
2) Importance Factor: 1.0
3) Exposure Category: B

c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

1) Load Duration: 60 seconds or less.

2) Load Duration: 30 days.

d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

e. Specified Design Snow Loads: TBA, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."

f. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

1) Load Duration: 60 seconds or less.

g. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.

1) Load Duration: 30 days.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures

acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite 6.0 mm thick and a nominal 1/2-inch- (12.7-mm-) wide interspace.

4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
b. Solar Heat Gain Coefficient: NFRC 200.
c. Solar Optical Properties: NFRC 300.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: 12-inch- (300-mm-) square, for each type of glass product indicated, other than monolithic clear float glass.

C. Glazing Schedule: Use same designations indicated on Drawings.

D. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

1.5 QUALITY ASSURANCE

A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

B. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
   2. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
   3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council or the Associated Laboratories, Inc.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Build mockups: Requirements TBD.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

   1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Product: Subject to compliance with requirements, provide product specified.
4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
5. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GLASS PRODUCTS

A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide tempered glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements.
2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
3. Sealing System: Dual seal.
4. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

    a. Spacer Material: Aluminum with mill or clear anodic finish
    b. Corner Construction: Manufacturer's standard corner construction.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.

5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants.

a. Products:

1) Pecora Corporation; 864
2) Dow Corning Corporation; 790
3) Tremco; Spectrem 1 (Basic)

b. Type and Grade: S (single component) and NS (nonsag).
c. Class: 50.
d. Use Related to Exposure: NT (nontraffic).
e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
f. Applications: TBD.

2. Neutral-Curing Silicone Glazing Sealants:

a. Products:

1) Tremco; Proglaze
2) Dow Corning Corporation; 799
3) GE Silicones; Ultraglaze SSG4000

b. Type and Grade: S (single component) and NS (nonsag).
c. Class: [25] [50].
d. Use Related to Exposure: NT (nontraffic).
e. Uses Related to Glazing Substrates: [M], G, A, and, as applicable to glazing substrates indicated, O.
f. Applications: Types of glazing applications where this sealant is required: TBD.

3. Acid-Curing Silicone Glazing Sealants GS-<#>:

a. Products:

1) Pecora Corporation; 860
2) Bostick Findley; Chem-Calk 1200
3) Tremco; Proglaze

b. Type and Grade: S (single component) and NS (nonsag).
c. Class: 25.
d. Use Related to Exposure: NT (nontraffic).
e. Uses Related to Glazing Substrates: G, A, and, as applicable to glazing substrates indicated, O.
f. Applications: Types of glazing applications where this sealant is required TBD.

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.8 INSULATING-GLASS UNITS

A. Clear/Tinted Insulating-Glass Units:

1. Products:

a. Viracon VE-2m LOW-E 1” Insulated Glass Unit (IGU) See Section 085113 Aluminum Windows.

b. PPG Solarban 60. Insulated Glass Unit (IGU) See Section 085113 Aluminum Windows.

c. Guardian Low-E Windows flor Panda Sliding Doors.

2. Interspace Content: Argon.

a. Glass qualities.

3. Visible Light Transmittance: 70 percent minimum.
4. Winter Nighttime U-Factor: 0.24 maximum.
5. Summer Daytime U-Factor: 0.28 maximum.
6. Solar Heat Gain Coefficient: 0.210 percent maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

4. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
6. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

    a. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
    b. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

7. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
8. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
9. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
10. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
11. Polish exposed edges.

B. Tape Glazing

1. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

2. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
3. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
4. Apply heel bead of elastomeric sealant.
5. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
6. Apply cap bead of elastomeric sealant over exposed edge of tape.

C. Gasket Glazing (Dry):

1. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

2. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
3. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
4. Install gaskets so they protrude past face of glazing stops.

D. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.4 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 089000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fixed, extruded-aluminum louvers.

B. See Division 8 Section "Hollow Metal Doors and Frames" for louvers in hollow-metal doors and frames.

C. See Division 15 Sections for louvers that are a part of mechanical equipment.

1.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide louvers that allow for thermal movements resulting from a temperature change (range) of 120 deg F, ambient; 180 deg F, material surfaces, by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

B. Air-Performance, Water-Penetration, and Wind-Driven Rain Ratings: As demonstrated by testing manufacturer's stock units according to AMCA 500-L.

1.3 SUBMITTALS

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

B. Samples: For each type of finish.

C. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Louvers:
    a. Cesco Products.
    b. Construction Specialties, Inc.
    c. Dowco Products Group; Safe-Air of Illinois, Inc.
    d. Nystrom Building Products.
    e. Reliable Company.

2. Model: Storefront Louvers to be Reliable 15045Z with insect screen. Unit grills to match Construction Specialties Inc. (C/S Products), Model 0292, A-Frame 65% Free Area, 1" depth. Finish to match aluminum window frames.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

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

2.3 FABRICATION, GENERAL

A. Fabricate frames to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to louver blades with fillet welds concealed from view.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
2. Performance Requirements:

    a. Free Area: Not less than 7.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
    b. Point of Beginning Water Penetration: Not less than 900 fpm.
    c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area velocity.

3. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 LOUVER SCREENS

A. General: Provide screen at interior face of each exterior louver.

B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

C. Louver Screening:

1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

2.6 BACK-UP ALUMINUM PANELS

A. Metal Werks Arcwall 1500 or equal.

2.7 FINISHES

A. Aluminum, Baked-Enamel Finish: Clean with inhibited chemicals and apply conversion coating and primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils, medium gloss.

1. Color: To match window frames.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged 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.

E. 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.

END OF SECTION 089000

SECTION 092116 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Shaft-wall enclosures.

1.2 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

1.3 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. 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. American Gypsum Company.
2. BPB America Inc.
3. G-P Gypsum.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland Forest Products Corporation.

8. USG Corporation.

2.2 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

2.3 PANEL PRODUCTS

A. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.

1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.

a. Core: 1 inch thick.
b. Long Edges: Double bevel.

2. Moisture- and Mold-Resistant Type X: Manufacturer's proprietary liner panels and with moisture- and mold-resistant core and surfaces; comply with ASTM D 3273.

a. Core: 1 inch thick.
b. Long Edges: Double bevel.

B. Gypsum Board: As specified in Division 09 Section "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Framing Members: Comply with ASTM C 754 for conditions indicated.

B. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

C. Gypsum Base Joint-Reinforcing Materials: As specified in Division 09 Section "Gypsum Veneer Plastering."

D. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board."

E. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.

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).

F. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

G. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

H. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.6 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing agency.

B. Fire-Resistance Rating: As indicated.

C. STC Rating: As indicated.

D. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: As indicated.

E. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches long and in depth matching studs.

1. Minimum Base-Metal Thickness: As indicated.

F. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Dietrich Metal Framing; The System by Metal-Lite, Inc.
b. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.

G. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0329 inch thick.

H. Room-Side Finish: As indicated.

I. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

J. Insulation: Sound attenuation blankets.

PART 3 - EXECUTION

3.1 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 07 Section "Applied Fireproofing."

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runner tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft-wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.2 INSTALLATION

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:

1. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
2. Division 09 Section "Gypsum Board" for applying and finishing panels.

B. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

1. At elevator hoistway entrance door frames, provide jamb struts on each side of door frame.
2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum board face-layer panel.

D. Integrate stair hanger rods with gypsum board shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.

E. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

F. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

G. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

H. Control Joints: Install control joints according to ASTM C 840 and in specific locations, as approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.

I. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.

J. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 4 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections. No recesses allowed (at steel beams especially).

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft-wall framing.
2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft-wall framing.

K. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

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

END OF SECTION 092116

SECTION 092900 - GYPSUM BOARD

Part 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Applicable provisions of the Conditions of the Contract and Division #1, General Requirements, govern work in this Section.

1. Mineral wool sound attenuation blanket and firestopping.

1.2 SCOPE OF WORK

A. Work Included

1. Gypsum board partition systems as shown.
2. Suspended gypsum board ceiling construction and gypsum board fascia construction.
3. Exterior gypsum board for backing for Terracotta rainscreen system.
4. Moisture resistant wall board at all toilet and kitchen area vertical surfaces.
5. Cement composition backer board at tub surround.
6. Gypsum Board furring.
7. Gypsum board furring for mechanical/electrical work.
8. Corner beads, casing beads and control joints for wall board construction.
9. Acoustical sealant at perimeters not taped.
10. Taping and finishing of gypsum wall board.
11. Abuse resistant gypsum wall board.

B. Related Work Specified Elsewhere

1. Rough Carpentry Div 6
2. Joint Sealants Div 7
3. Hollow Metal Work Div 8
4. Painting Div 9
5. Mechanical and Electrical Work (Divisions 15 and 16).

1.3 SUBMITTALS REQUIRED

A. Samples of materials to be incorporated in the work, as required by the Architect.

1.4 PRODUCT HANDLING

A. Deliver materials in original containers bearing brand name and identification of manufacturer or supplier.

B. Store materials in manner to keep them dry, protected from soiling or damage. Neatly stack gypsum boards flat to prevent sagging. Do not overload floors.

C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from damage.

1.5 PROJECT CONDITIONS

A. Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Metal Support Materials

a. Gold Bond Building Products Div., National Gypsum Co.
b. Milcor Division, Inryco Inc.
c. Marino Industries
d. United States Gypsum Co.

2. Gypsum Board and Related Products

a. Flintkote Products, Genstar Building Materials Co.
b. Georgia-Pacific Corp.
c. Gold Bond Building Products Div., National Gypsum Co.
d. United States Gypsum Co.

B. General: Except as otherwise required by governing regulations, provide the manufacturer's standard materials specified in his published product literature for the system and application required.

2.2 METAL SUPPORT MATERIALS

A. Ceiling Support Materials and Systems

1. General: Size ceiling supports to comply with ASTM C 754.

2. Main Runners: Provide steel channels with rust inhibitive paint finish, hot or cold-rolled, when required by building code, or when direct attachment of furring to joists is not feasible.
3. Hangers: 1/4" galvanized steel rods or flat bar hangers.
4. Hanger Anchorage Devices: Devices for ceiling hangers whose suitability has been proven by construction practices or by certified test data. Size devices for 3x calculated load.
5. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat-shaped.
6. Furring Anchorages: ASTM C 74; standard wire clips, bolts, nails or screws as recommended by furring manufacturer.

B. Wall/Partition Support Materials

1. Studs: ASTM C645; 0.0179" min. thickness of base metal.
   a. Depth of Section: Standard sizes as shown.
   b. Metal studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of wall board work at other work.
2. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat-shaped, unless otherwise shown.
3. Fasteners for Furring Members: Type and size recommended by furring manufacturer for the substrate and application shown.
4. Steel strapping for attachment of cabinets and the like: 6" wide, 20 gage minimum.

C. Structural Framing Members: ASTM C955; studs and runners of size, shape and gage as shown or as recommended by manufacturer for shaft wall construction and for other special partitions.

2.3 GYPSUM BOARD

A. Gypsum Wallboard: ASTM C 36, 1/2" or 5/8" thick with tapered edges, unless otherwise required, in maximum lengths available.

1. Regular, unless otherwise required.
2. Type X; for fire-resistant rated assemblies.
3. Water Resistant; ASTM C630, Type X.
4. Backing Board: cement composition board.
5. Abuse resistant gypsum board, in lobbies and elevator foyers. United States Gypsum, Sheet AR. Imperial Base with diamond veneer.

2.4 TRIM ACCESSORIES

A. Provide standard trim accessories for wall board work, of galvanized steel, beaded for concealment of flanges. Provide corner beads, edge trim-beads and one-piece control joint beads, of size and shape to suit installation conditions.

B. Vinyl or PVC trim shall be used at window jambs and where recommended by the gypsum board manufacturer, when it does not conflict with reference standards or performance requirements.
C. Provide 1-1/2” Aluminum Z-Clips 53732 by Monarch, located in public space, see drawings.

2.5 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

3. Core: 1/2 inch (12.7 mm), regular type.

B. Glass-Mat, Water-Resistant Backing Board:

1. Complying with ASTM C 1178/C 1178M.

a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.

2. Complying with ASTM C1177/C 1177M.

a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.

3. Core: 1/2 inch (12.7 mm), regular type.

C. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Custom Building Products; Wonderboard.
b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.

c. USG Corporation; DUROCK Cement Board.

3. Thickness: 1/2 inch (12.7 mm).

2.6 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS AND SHEATHING AT TERRACOTTA RAINSCREEN SYSTEM

A. Exterior Gypsum Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

3. Thickness 5/8 inch (15.9 mm), Type X.

B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum.
2. Thickness : 5/8 inch (15.9 mm), Type X.

2.7 JOINT TREATMENT MATERIALS

A. A.General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
3. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum wall board work of the type and grade recommended by the gypsum board manufacturer.

B. Gypsum Board Screws: Comply with ASTM C 646 and ASTM C1002.

C. Acoustical Sealant: Comply with ASTM C 834.

D. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer

PART 3 - EXECUTION

3.1 CEILING SUSPENSION SYSTEMS

A. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners.

B. Space main runners 4'-0" o.c. and space hangers 4'-0" o.c.

C. Level main runners to a tolerance of 1/4" in 12'-0", measured lengthwise on each runner and between parallel runners.

D. Clip furring members to main runners and to structural supports.

E. Space furring member 16" o.c., except as otherwise required.

F. Install auxiliary framing at termination of wall board work as required for support of the wall board construction and other work supported on wall board.

3.2 WALL SUPPORT SYSTEMS

A. Metal Support Installation Standard: Comply with ASTM C754.

B. Comply with applicable printed recommendations of gypsum board manufacturer, or "Gypsum Construction Handbook" by United States Gypsum Company.

C. Isolate stud system from structural loading. Provide slip or cushioned type joints for lateral support without axial loading.

D. Install runner tracks at floors, ceilings and structural walls and columns where gypsum wall board stud system abuts other work.

E. Terminate partition stud system at underside of subflooring above, unless otherwise indicated.

F. Space studs and wall furring members 24" o.c., unless otherwise indicated. Space studs 16" o.c. at kitchen cabinet walls and tub support walls.

1. Coordinate the installation of studs and wood and steel strap blocking for adequate support of cabinets, handrails, railings, shelf cleats and shelving, wood bases, stools, heating enclosures and other items attached to gypsum wall board construction. Coordinate with Sections 06100 and 11450.

G. Frame door openings with doubled vertical studs attached to jambs. Install runner track section (for jack studs) at head and secure to jamb studs. Extend vertical jamb studs through suspended ceilings and attach to underside of structure above.

H. Coordinate with Section 07500 for the installation of insulation to fill spaces between metal supports.

3.3 GYPSUM BOARD INSTALLATION, GENERAL

A. Application and Finishing Standards: ASTM C 840 and GA 216.

B. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.

C. Install ceiling board to minimize the number of end-butt joints, and avoid end joints in the central area of each ceiling.

D. Install boards vertically to avoid end-butt joints wherever possible. At high walls, install boards horizontally with the end joints staggered over studs.

E. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.

F. Locate joints over supports, except where intermediate supports are provided. Position boards so that the same kind of edges abut.

G. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

H. Form control joints and expansion joints where shown, with space between edges of boards, prepared to receive trim accessories. Isolate perimeter of wall board partitions at structural abutments.

I. Seal perimeters, control joints, openings and penetrations with a continuous bead of acoustical sealant. Comply with ASTM C 919 and manufacturer's recommendations for locations of beads.

J. Space screw fasteners in gypsum board in accordance with referenced standards and manufacturer's recommendations.

3.4 GYPSUM BOARD APPLICATIONS

A. General: Install gypsum board in single and multiple layers of thicknesses as shown, to meet required fire-resistance and acoustical ratings, using screw fasteners. Use laminating adhesive to bond gypsum board securely to concrete or masonry.

B. Wet Walls: Install water-resistant gypsum board in bathrooms and kitchens, including adjacent painted surfaces in these areas.

C. Tiled Walls: Install cement composition backing board at surfaces to receive tile.

D. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.5 APPLYING TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

C. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.

D. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

E. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF ACCESSORIES

A. Fasten flanges in accordance with manufacturer's instructions.

B. Install metal or vinyl corner beads at external corners of wall board work. Install metal or vinyl edge trim at exposed edges of gypsum board.

3.6 FINISHING OF WALL BOARD

A. Finish gypsum board joints, flange of trim, penetrations, fasteners, surface defects for finishing. Prefill open joints and edges.

B. Apply joint tape at joints between gypsum boards, except where trim accessories are used.

C. Apply joint compound in 3 coats, not including prefill of openings in base, and sand last 2 coats. Use compounds recommended for each difference kind of gypsum board. Finished surfaces shall be smooth and free from defects.

END OF SECTION 092900

SECTION 093000 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Quarry tile.
3. Pressed floor tile.
4. Porcelain tile.
5. Glazed wall tile.
6. Stone thresholds.
7. Tile backing panels.
8. Waterproof membrane for thinset applications.
9. Crack isolation membrane.
10. Metal edge strips.

B. Related Requirements:
1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 36 inches (900 mm), but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch (150-mm) lengths.
5. Metal edge strips in 6-inch (150-mm) lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Cementitious backer units.
5. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Ceramic Tile Type [**CT-<#>**]: Factory-mounted glazed ceramic mosaic tile.

1. Manufacturer:
2. Composition:
3. Certification:
4. Module Size:
5. Thickness:
6. Dynamic Coefficient of Friction: Not less than 0.42.
7. Finish: As selected by Architect from manufacturer's full range.
8. Tile Color / Pattern: As selected by Architect from manufacturer's full range.
9. Grout Color: As selected by Architect from manufacturer's full range.

B. Ceramic Tile Type [**CT-<#>**]: Unglazed porcelain tile.

1. Manufacturer:
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size:
4. Face Size Variation: Rectified.
5. Thickness:
6. Dynamic Coefficient of Friction: Not less than 0.42.
7. Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
8. Grout Color: As selected by Architect from manufacturer's full range.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/4 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 12 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.
2. Description: Match Architect's sample.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A, in maximum lengths available to minimize end-to-end butt joints.

1. Fin-Pan Inc
2. Georgia Pacific Gypsum
3. USG Corporation
4. Thickness: 5/8 inch (15.9 mm).

B. Fiber-Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.

1. Certainteed / St Gobain
2. Thickness: 1/2 inch (12.7 mm)

2.6 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

C. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

D. Waterproofing and Tile-Setting Adhesive: One-part, fluid-applied product intended for use as both waterproofing and tile-setting adhesive in a two-step process.

2.7 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

C. Crack Isolation Membrane and Tile-Setting Adhesive: One-part, fluid-applied product intended for use as both a crack isolation membrane and tile-setting adhesive in a two-step process.

2.8 SETTING MATERIALS

A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

1. Laticrete
2. Mapei
3. Bostick
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

B. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thinset): ANSI A118.11.
1. Laticrete
2. Mapei
3. Bostick
4. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
5. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

2.9 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

C. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.

C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; half-hard brass exposed-edge material.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Exterior tile floors.
    b. Tile floors in wet areas.
    c. Tile swimming pool decks.
    d. Tile floors in laundries.
    e. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    f. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Glazed Wall Tile:[1/16 inch (1.6 mm).
3. Porcelain Tile: [1/16 inch (1.6 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).
2. Do not extend waterproofing or crack isolation membrane under thresholds set in standard dry-set modified dry-set or improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.

K. Metal Edge Strips: Install at locations indicated where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

L. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 EXTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Exterior Wall Installations, Masonry or Concrete:

1. Ceramic Tile Installation: TCNA W202; thinset mortar over waterproof membrane.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Modified dry-set mortar.
c. Grout: High-performance unsanded grout.

3.10 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation <**Insert designation**>: TCNA F113; thinset mortar.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Standard dry-set mortar.
c. Grout: Standard sanded cement grout.

2. Ceramic Tile Installation <**Insert designation**>: TCNA F122; thinset mortar on waterproof membrane.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Modified dry-set mortar.
c. Grout: High-performance sanded grout.

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation <**Insert designation**>: TCNA W243; thinset mortar on gypsum board.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Standard dry-set mortar.
c. Grout: Standard unsanded cement grout.

2. Ceramic Tile Installation <**Insert designation**>: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Standard dry-set mortar.
c. Grout: Standard unsanded cement grout.

3. Ceramic Tile Installation <**Insert designation**>: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Standard dry-set mortar.
c. Grout: Standard unsanded cement grout.

C. Bathtub Wall Installations with No Shower Head, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation <**Insert designation**>: TCNA B413; thinset mortar on water-resistant gypsum board.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Standard dry-set mortar.
c. Grout: Standard unsanded cement grout.

2. Ceramic Tile Installation <**Insert designation**>: TCNA B412; thinset mortar on cementitious backer units or fiber-cement backer board.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: Standard dry-set mortar.
c. Grout: Standard unsanded cement grout.

END OF SECTION 093000

SECTION 096401 – WOOD FLOORING

PART I – GENERAL

1.1 SECTION INCLUDES

1. Hardwood Flooring
2. Maintenance materials.
3. Finish moldings

1.2 RELATED SECTIONS

1. Section: 03 30 00 - Cast-in-place Concrete
2. Section: 06 10 00 - Rough Carpentry

A. Alternates
   1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addendum. If included in a Bid are substitute products which have not been approved by Addendum, the specified products shall be provided without additional compensation.
   2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); flooring design, size, composition, color, and finish; Trims, Moldings, sizes; Compliance with the referenced standards.

1.3 REFERENCES

American Society for Testing and Materials (ASTM):
A. ASTM E648 –Standard Test Method for critical Radiant Flux of Floor Covering systems using a radiant heat energy sources 0.45 watts/cm^2 or greater, Class 1.
B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
C. ASTM F710 - Practice for Preparing Concrete Floors.
D. ASTM F2170-09 Standard test method for determining relative humidity in concrete slabs using In-Situ-probes.

1.4 SUBMITTALS

A. Submit product data in accordance with Section (01 30 00) (01 33 00), including the manufacturer’s installation and maintenance instructions.
B. Submit three representative samples of the Hardwood Flooring in the final color(s) or custom color(s), and species with UV cured finish if selected by the owner or their representative.

C. Installer Certification: Submit a list of at least three installations successfully completed within the past year requiring the same general degree of installation expertise.
D. Shop Drawings: Show floor pattern layout.

1.5 QUALITY ASSURANCE

A. Installer: Shall be experienced in the wood and/or vinyl tile flooring industry and shall have a minimum of five (5) years experience in the installation of similar products.
B. Pre-Installation meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.
C. Mock-ups: At the project site, install a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish color, texture and workmanship standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver the flooring to a preferred 35-55% relative humidity job site in unopened cartons. Protect flooring from exposure to moisture. Moisture producing activities such as drywall, concrete, masonry, painting and grouting must be complete and cured prior to the delivery of wood flooring.
B. Cartons of Hardwood Flooring should be delivered to the site on the day of installation. No acclimation time is necessary for installing Hardwood Flooring.
C. Cartons of wood should be stored in dry, well ventilated storage areas or warehouses. Never store cartons of flooring outdoors. The ideal storage area environment should be kept at 35-55% relative humidity and 60-80^{o}F . Do not store cartons of flooring directly on concrete floors.

1.7 PROJECT CONDITIONS

A. Provide permanent HVAC operation (2 week minimum) and permanent lighting prior to installation.
B. Maintain room temperature between 60-80^{o}F and relative humidity between 35% and 55%, prior to, during and after the installation. Keep in mind that if the relative humidity drops below 35% for extended periods, the flooring may contract causing unsightly splits and gaps.
C. Do not install flooring until all other significant construction work is complete. Close spaces to traffic during the installation of the flooring and protect the surface as necessary with a breathable material after the completion of the installation.
D. Do not install flooring over concrete slabs until they are dry enough to achieve a bond with the adhesive in accordance with the manufacturer's recommended bond and moisture test.

1.8 WARRANTY

Hardwood Flooring offers a 10 year Limited Finish Warranty and Full Lifetime Structural Integrity Warranty. Full lifetime adhesive bond warranty is also offered when using Armstrong approved recommended adhesives.

1.9 MAINTENANCE

Prior to turning the floor over to the owner, it shall be thoroughly cleaned by sweeping, vacuuming or dust mopping to remove debris, followed by cleaning with Armstrong Hardwood and Laminate Floor Cleaner.

A. Initial Care: Remove any adhesive residue or petroleum based products with the appropriate cleaner (low odor mineral spirits). Urethane adhesive should be removed with the appropriate urethane adhesive cleaner. Thoroughly clean the floor with Armstrong Hardwood and Laminate Floor Cleaner. Dampen a CLEAN cloth with the materials, do not soak. DO NOT USE dirty mops or those that contain the residue of dust attracting compounds. Dust mop the floor as normal, misting the materials periodically while proceeding throughout the installation.
B. Routine Care (daily)-Clean the floor as needed with Armstrong Hardwood and Laminate Floor Cleaner (see above for application recommendations).
C. Periodic Care (weekly-monthly)-Dust mop the floor as recommended under daily care. Buff the floor using a medium high speed buffer (175-750 RPM) and white/buff colored buffing pads. Apply Armstrong Hardwood and Laminate floor cleaner to the surface in the path of the buffing machine using a misting bottle while proceeding throughout the installation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Flooring, adhesive, maintenance materials and other components shall be produced by Armstrong or certified as compatible with components produced by Armstrong.

2.2 WOOD FLOORING MATERIALS

A. Species: Per finish schedule.
   2. Dimensions:
      Width: Per finish schedule.
      Thickness: Per finish schedule.
      Length: Variable: 18” – 48”
      Wear layer thickness: N/A
      Number of plys: N/A
   3. Finish:
   4. Construction: Solid Plank
   5. Edge detail/End detail: N/A
   7. Milling: Tongue and groove sides, end matched.
   8. Fire Ratings: ASTM E648 Critical Flux of 0.45 watts/cm^2 or greater, Class 1.
B. Adhesive:
C. Mechanical fasteners: as recommended for machine but not less than 1-3/16” in length.
D. Select Maintenance Materials:

2.3 ACCESSORIES

A. Provide all available coordinating transition and molding pieces designated to meet installation application for finishing and transitioning to other floor products. Install in accordance with Armstrong's guidelines and intended use.
B. For completing minor repairs during installation provide coordinated Armstrong acrylic filler or touch-up kit that corresponds and blends with the product color.
C. For added noise reduction, sound absorption, thermal insulation, and moisture barrier provide Armstrong's S-1836 Quiet Comfort Premium Underlayment Or S-1837 Quiet Comfort Underlayment for floating Applications.
D. For completing glue down applications use Bruce Equalizer Or Armstrong 57 premium urethane adhesives.
E. For moisture remediation on concrete slabs tested with ASTM method F 1869 exceeding maximum Hardwood requirement of 3 lbs/1000 ft2/24 hr period, not to exceed 12 lbs/1000 ft2/ 24 hr Moisture Vapor Emission Rate (MVER) use Armstrong VapArrest (S-135) Professional Moisture Retardant System. For Glue down installations over S-135 use the recommended Urethane adhesives only. Floating installations can be installed over S-135.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Subfloor
1. Verify that the substrate is clean and free of laitance, loose material, grease, oil, coatings and other contaminants that will interfere with the bonding of the adhesive. Concrete surface sealers must be removed if present.
2. Verify that the substrate is flat, smooth, free from cracks, holes, and ridges and other defects impairing performance or appearance.
3. Verify that new slab cure is a minimum of 30 days, preferably 60 days.
4. Verify the concrete is visually sound and dry. Calcium Chloride Moisture Tests
5. (ASTM F1869) or Internal Relative Humidity Test (ASTM F2170-09 In-Situ Probe Test) must be performed for warranty consideration. Using Armstrong 57 or Bruce Equalizer in direct to concrete applications moisture vapor transmission must not exceed 3 lbs./1000 square feet/24 hrs, In-Situ Probe test not to exceed 75% RH. If vapor transmission rate exceeds 3 lbs/1000 square feet/24hrs and is less than 12 lbs./1000 square feet/24hrs or RH is excess of 75%. Apply Armstrong VapArrest Moisture Retardant System as directed.
6. Concrete Alkalinity: Verify that PH levels of the concrete are 5-9 (ASTM F710).

B. Wood Subfloors
1. Must be dry, clean, structurally sound, flat to within 3/16" in 10 ft., well nailed and/or glued, free of voids and with flat joint alignment.
2. The wood subflooring materials should not exceed 13% moisture content. Using a reliable wood moisture meter, check the moisture content of the subfloor.
3. Ensure that all nail heads are set flush with or below surface.
4. Must be sanded smooth to remove varnish, high edges, chips, or other contaminants. Use thick 5/8" (16mm) or 3/4" (19mm) APA-CDX grade underlayment plywood or equivalent.

5. Allow 1/8"-1/4" (3,2-6,4mm) expansion space between sheets with staggered joints. Leave 3/4" (19mm) minimum expansion space at all vertical obstructions.

C. All Subfloors
   1. Coordinate work with that of other trades prior to installation so that no discrepancies exist with the installation of doors, frames, saddles, floor drains or any materials that would interfere in any other way.
   2. Notify Architect of moisture test results and any unsatisfactory conditions. Do not begin installation until unsatisfactory conditions have been corrected. Beginning the installation means that the substrate and job site conditions have been accepted as suitable. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the sub-floor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

A. Scour all concrete surfaces, except when using floating method, using 3 ½ open coat (20 grit) sand paper.
B. Sweep and vacuum substrate, and ensure that surface is free of oil, grease, wax, dust, or any other foreign substances.
C. Use Armstrong S-194 Patch, Underlayment and Embossing Leveler with S-195 Latex Underlayment Additive to patch cracks, holes and depressions of small areas. Sand and/or scour patched areas smooth after material is cured. Use only quality materials and/or products, which do not contain gypsum.
D. If approved self-leveling underlayments are used, they must dry sufficiently (run moisture test) and be sanded smooth before installing floor. Armstrong is not responsible for strength, adhesion, or general performance of underlayments as proper compounding and preparation of subsurface is the responsibility of the installer.

3.3 INSTALLATION

NOTE: A Mechanical Fastener, direct-bond glue or floating installation must be specified. Complete installation instructions for all types of installations are included in each carton of hardwood flooring or at Armstrong.com

A. Floating floor will utilize Armstrong Quiet Comfort or Armstrong Quiet Comfort Premium foam underlayment and Armstrong 99 Hardwood & Laminate Flooring Adhesive.
B. Follow manufacturer's installation instructions supplied in each carton of material.
C. Spread adhesive using recommended trowel per manufacturer's instructions.
D. Always install while adhesive is still wet.
E. Spread adhesive only over surface that can be finished within working time of the adhesive.
F. It is extremely important to remove excess adhesive using low odor mineral spirits while the adhesive is still fresh. Cured adhesive cannot be removed.
G. Scribe, cut and fit to permanent fixtures, columns, walls, partitions, pipes, outlets and built-in furniture and cabinets leaving the manufacturer's required expansion space. Install the flooring with adhesives, tools and procedures in strict accordance with the manufacturer's written instructions. Follow the

recommended adhesive trowel notching, open times and working times. If mechanical fastening the flooring follow the correct fastener and staples as provide in the manufacturer's instructions.

H. Install trim, molding and transition strips per manufacturer's installation instructions.

3.4 PROTECTION

Protect finished floor from abuse by other trades using heavy kraft paper or equivalent. Keep traffic out of spaces and areas where flooring is being installed until adhesive has set. Light foot traffic after 10-12 hours. Normal traffic after 24 hours.

A. Preventive Maintenance
   Mats at all entrances help keep dirt and moisture from being tracked in. Mats should be slip-resistant with a backing that is breathable and will not discolor the floor. Vacuum, sweep or dust mop regularly. Never damp mop with water as it may permanently damage the floor. Use Armstrong Hardwood and Laminate Floor Cleaner to remove spills or spots. For stubborn spots, use low odor mineral spirits. Satisfactory performance of wood floors is greatly influenced by its environmental conditions. A temperature of 70°F (21°C) and relative humidity between 35% and 50% is ideal. Humidifiers can be used during the drier times to eliminate cracks that can be caused by excessive drying of wood. Dehumidifiers or air conditioners can be used to prevent wood floors from buckling by reducing high humidity levels.
   As with all hardwood flooring, it is important to properly clean and maintain wood floors to prevent substances, including but not limited to water, food and grease, from making the floor slippery.
B. Water Spots
   Minerals or chemicals in water may cause spotting when water from spills evaporates. These spots can be removed with a soft cloth dampened with Armstrong Hardwood and Laminate Floor Cleaner or white vinegar.
C. Scratches
   For light scratches or color loss use Armstrong Touchup kit or Acrylic filler. Repairs may also be made by replacing individual boards.
D. Rubber Heel Marks, Crayon, Gum or Asphalt Deposits
   Dampen a clean cloth with Mineral Spirits and rub to remove.

SECTION 099120 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial painting, including surface preparation
   1. Interior painting.
   2. Exterior painting.

1.2 RELATED SECTIONS - INTERIOR

A. Division 3 - Concrete - Walls and Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place including Plaster (Walls, Ceilings, Concrete - (Floors, non-vehicular).

B. Division 5 - Metal - Galvanized.

C. Division 6 - Wood - Doors, Trim, Paneling.

D. Division 9 - Drywall - (Walls, Ceilings, Gypsum Board and similar items).

1.3 RELATED SECTIONS - EXTERIOR

A. Division 3 - Concrete - Cementitious Siding, Flexboard, Transite Board, Shingles (Non-Roof), Common Brick, Stucco, Tilt-up, Precast, and Poured-in-place Cement.

B. Division 5 - Metal - Galvanized, Miscellaneous Iron, Ornamental Iron, Structural Iron and Steel, Ferrous Metal.

C. Division 6 - Wood - Decks, Exterior including pressure treated lumber, Floors (non-Vehicular).

D. Division 7 - Wood - Siding, Trim, Shutters, Sashes, Hardboard-Bare/Primed, Architectural PVC, Plastic, Fiberglass, Azek, Vinyl Siding, EIFS, Synthetic Stucco.

1.4 REFERENCES

A. Green Seal Standard GS-11; May 20, 1993.

B. US Green Building Council, (USGBC) - Green Seal standards for LEED paint credits.

C. Occupational Safety and Health Act (OSHA) - Safety Standards.

D. American National Standards Institute (ANSI) - Performance Standards.

E. Paint Decorating Contractors of America (PDCA) - Application Standard.

F. National Paint and Coatings Association (NPCA) - Gloss Standard.

G. American Society for Testing Materials (ASTM) - Testing Methods.

H. Master Paint Institute (MPI #) - Established paint categories and standards.

I. Ozone Transmission Commission (OTC) - Established levels of Volatile Organic

Compounds.

J. SCAQMD 1168 - South Coast Air Quality Management District Rule #1168; October 3, 2003.

K. SSPC (PM1) - Steel Structures Painting Manual, Vol. 1, Good Painting Practice; Society for Protective Coatings; 1993, Third Edition.

L. SSPC (PM2) - Steel Structures Painting Manual, Vol. 2, Systems and Specifications; Society for Protective Coatings; 1995, Seventh Edition.

M. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

1.5 DEFINITIONS

A. Commercial as used in this Section refers to a product well suited for a commercial application.

B. DFT as used in this Section refers to the Dry Film Thickness of the coating.

C. Enamel refers to any acrylic or alkyd (oil) base paint which dries leaving an eggshell, pearl, satin, semi-gloss or high gloss enamel finish.

D. DTM as used in this Section refers to paint that is applied Direct To Metal.

E. LEED as used in this Section refers to Leadership in Energy and Environmental Design. Products listed meet LEED criteria for environmentally safe interior primers, paints and coatings.

F. OTC as used in this Section refers to the Ozone Transmission Commission. OTC has established the following VOC levels for the Northeastern United States. Products shall meet the following OTC limits for VOC's.
1. Interior flat paints: 50 grams per liter or less, per gallon.
2. Interior enamels: 50 grams per liter or less, per gallon.
3. Interior stains: 250 grams per liter or less, per gallon.
4. Interior primers: 50 grams per liter or less, per gallon.
5. Rust preventive coatings: 250 grams per liter or less, per gallon.
6. Dry fog coatings: 400 grams per liter or less, per gallon.
7. Floor coatings: 50 grams per liter or less, per gallon.

G. Premium as used in this Section refers to the best quality product "top of the line".

H. VOC as used in this Section refers to Volatile Organic Compounds found in primers, paints, sealers and stains. The level of VOCs appears after each product listed in the Schedule in grams per liter (g/L).

I. Paints are available in a wide range of sheens or glosses, as measured by a gloss meter from a 60 and/or 85 degree angle from vertical, as a percentage of the amount of light that is reflected. The following terms are used to describe the gloss of our products. The list below is provided for general guidance; refer to the technical data sheet for the actual gloss/sheen level for each product.
1. Flat - Less than 5 Percent.
2. Eggshell - 5 - 20 Percent.
3. Satin - 20 - 35 Percent.
4. Semi-Gloss - 30 - 65 Percent.
5. Gloss - Over 65 Percent.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300 - Administrative Requirements.

B. Product Data: Provide a complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category.
   2. Cross-reference to specified paint system(s) that the product is to be used in; include description of each system.

C. Samples: Submit three paper samples, 5 inches by 7 inches (127mm x 178mm) in size, illustrating selected colors for each color and system selected with specified coats cascaded.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

B. Installer Qualifications: All products listed in this section are to be applied by a Painting Contractor with a minimum of five years demonstrated experience in surface preparation and field application of the same type and scope as specified.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Mock-up areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Approved mock-up areas will serve as the standard for remaining Work.
   4. Refinish mock-up area as required to produce acceptable Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Disposal:
   1. Never pour leftover coating down any sink or drain. Use up material on the job or seal can and store safely for future use.
   2. Do not incinerate closed containers.
   3. For specific disposal or recycle guidelines, contact the local waste management agency or district. Recycle whenever possible.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 WARRANTY

A. Inspection of all surfaces to be coated must be done by the manufacturer's representative to insure proper preparation prior to application. All thinners, fillers, primers and finish coatings shall be from the same manufacturer to support a product warranty. Products other than those submitted shall be accompanied by a letter stating its fitness for use and compatibility.

B. At project closeout, provide to the Owner or owner's representative an executed copy of the Manufacturer's standard form outlining the terms and conditions of and any exclusions to their Limited Warranty against Manufacturing Defect.

1.11 EXTRA MATERIALS

A. At project closeout, supply the Owner or owner's representative one gallon of each product for touch-up purposes. Cans shall be clearly marked with color name, number and type of paint.

B. At project closeout, provide the color mixture name and code to the Owner or owner's representative for accurate future color matching.

PART 2 PRODUCTS

1. Primer (1st coat): Benjamin Moore Fresh Start® High-Hiding All Purpose 046, 44 g/L, 6, 17, 17 X-Green, 39, 50, 50 X-Green, 137, 137 X-Green, Qualifies for LEED® v4 Credit, Qualifies for CHPS low emitting credits

2. Finish (2nd + 3rd coats): Benjamin Moore Interior Aura. See Finish Schedules for paint colors and finishes.

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Benjamin Moore and Co., which is located at: 101 Paragon Dr Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Email: info@benjaminmoore.com; Web:www.benjaminmoore.com
   1. In March 2008, Benjamin Moore finalized the purchase of select assets of Insl-x Products Corporation, including Insl-x®, Coronado®, and Lenmar®

2.2 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D-National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. 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.

B. Compatibility: Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 MIXING AND TINTING

A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted.

Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.

B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.

C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

PART 3 EXECUTION

3.1 EXAMINATION

A. The Contractor shall review the product manufacturer's special instructions for surface preparation, application, temperature, re-coat times, and product limitations.

B. The Contractor shall review product health and safety precautions listed by the manufacturer.

C. The Contractor shall be responsible for enforcing on site health and safety requirements associated with the Work.

D. Do not begin installation until substrates have been properly prepared.

E. Ensure that surfaces to receive paint are dry immediately prior to application.

F. Ensure that moisture-retaining substrates to receive paint have moisture content within tolerances allowed by coating manufacturer. Where exceeding the following values, promptly notify Architect and obtain direction before beginning work.
1. Concrete and Masonry: 3-5 percent. Allow new concrete to cure a minimum of 28 days.
2. Exterior Wood: 17 percent.
3. Interior Wood: 15 percent.
4. Interior Finish Detail Woodwork, Including Trim, and Casework: 10 percent.
5. Plaster and Gypsum: 15 percent.
6. Concrete Slab-On-Grade: Perform calcium chloride test over 24 hour period or other acceptable test to manufacturer. Verify acceptable moisture transmission and pH levels.

G. Examine surfaces to receive coatings for surface imperfections and contaminants that could impair performance or appearance of coatings, including but not limited to, loose primer, rust, scale, oil, grease, mildew, algae, or fungus, stains or marks, cracks, indentations, or abrasions.

H. Correct conditions that could impair performance or appearance of coatings in accordance with specified surface preparation procedures before proceeding with coating application.

3.2 PREPARATION - GENERAL

A. Clean surfaces thoroughly prior to coating application.

B. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.

C. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; cover stains and marks which cannot be completely removed with isolating primer or sealer recommended by coating manufacturer to prevent bleed-through.

D. Remove Mildew, Algae, and Fungus using materials and methods recommended by coating manufacturer.

E. Remove dust and loose particulate matter from surfaces to receive coatings immediately prior to coating application.

F. Remove or protect adjacent hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive coatings.

G. Move or protect equipment and fixtures adjacent to surfaces indicated to receive coatings to allow application of coatings.

H. Protect adjacent surfaces not indicated to receive coatings.

I. Prepare surfaces in accordance with manufacturer's instructions for specified coatings and indicated materials, using only methods and materials recommended by coating manufacturer.

3.3 SURFACE PREPARATION

A. Concrete and Concrete Masonry: Clean surfaces free of loose particles, sand, efflorescence, laitance, form oil, curing compounds, and other substances which could impair coating performance or appearance.

B. Gypsum Board: Repair cracks, holes and other surface defects with joint compound to produce surface flush with adjacent surfaces.

C. Masonry Surfaces - Restored: Remove loose particles, sand, efflorescence, laitance, cleaning compounds and other substances that could impair coating performance or appearance.

D. Metals - Aluminum, Mill-Finish: Clean and etch surfaces with a phosphoric acid-water solution or water based industrial cleaner. Flush with clean water and allow to dry, before applying primer coat.

E. Metals - Copper: Clean surfaces with pressurized steam, pressurized water, or solvent washing.

F. Metals - Ferrous, Unprimed: Remove rust or scale, if present, by wire brush cleaning, power tool cleaning, or sandblast cleaning; remove grease, oil, and other contaminants which could impair coating performance or appearance by solvent cleaning, with phosphoric-acid solution cleaning of welds, bolts and nuts; spot-prime repaired welds with specified primer.

G. Metals - Ferrous, Shop-Primed: Remove loose primer and rust, if present, by scraping and sanding, feathering edges of cleaned areas to produce uniform flat surface; solvent-clean surfaces and spot-prime bare metal with specified primer, feathering edges to produce uniform flat surface.

H. Metals - Galvanized Steel (not passivated): Clean with a water-based industrial strength cleaner, apply an adhesion promoter followed by a clean water rinse. Alternately, wipe down surfaces using clean, lint-free cloths saturated with xylene or lacquer thinner; followed by wiping the surface dry using clean, lint-free cloths.

I. Metals - Galvanized Steel, Passivated: Clean with water-based industrial strength cleaner. After the surface has been prepared, apply recommended primer to a small area. Allow primer to cure for 7 days, and test adhesion using the "cross-hatch adhesion tape test" method in accordance with ASTM D 3359. If the adhesion of the primer is positive, proceed

with a recommended coating system for galvanized metal.

J. Metals - Stainless Steel: Clean surfaces with pressurized steam, pressurized water, or water-based industrial cleaner.

K. Plaster: Repair cracks, holes and other surface defects as required to maintain proper surface adhesion. Apply patching plaster or Joint compound and sand to produce surface flush with adjacent undamaged surface. Allow a full cure prior to coating application as recommended by the patching compound manufacturer's recommendations.

L. Polyvinyl Chloride (PVC) Pipe: remove contaminants and markings with denatured alcohol scuff sand and wipe with solvent for maximum adhesion. Test adhesion before starting the job.

M. Fiberglass Doors - remove contaminants with cleaning solvent (alcohol) scuff sand and wipe. Test adhesion of primer before starting job.

N. Textiles - Insulated Coverings, Canvas or Cotton: Clean using high-pressure air and solvent of type recommended for material.

O. Wood:
1. Seal knots, pitch streaks, and sap areas with sealer recommended by coating manufacturer; fill nail recesses and cracks with filler recommended by coating manufacturer; sand surfaces smooth.
2. Remove mill marks and ink stamped grade marks.
3. Apply primer coat to back of wood trim and paneling.

P. Wood Doors: Seal door tops and bottoms prior to finishing.

Q. Wood Doors - Field-Glazed Frames and Sash: Prime or seal glazing channels prior to glazing.

3.4 APPLICATION - GENERAL

A. Application of primers, paints, stains or coatings, by the Contractor, will serve as acceptance that surfaces were properly prepared in accordance with the manufacturer's recommendation.

B. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.

C. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.

D. Inspect each coat before applying next coat; touch-up surface imperfections with coating material, feathering, and sanding if required; touch-up areas to achieve flat, uniform surface without surface defects visible from 5 feet (1.5 m).

E. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

F. Where paint application abuts other materials or other coating color, terminate coating with a clean sharp termination line without coating overlap.

G. Where color changes occur between adjoining spaces, through framed openings that are of same color as adjoining surfaces, change color at outside stop corner nearest to face of

closed door.

H. Re-prepare and re-coat unsatisfactory finishes; refinish entire area to corners or other natural terminations.

3.5 CLEANING

A. Clean excess coating materials, and coating materials deposited on surfaces not indicated to receive coatings, as construction activities of this section progress; do not allow to dry.

B. Re-install hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items that have been removed to protect from contact with coatings.

C. Reconnect equipment adjacent to surfaces indicated to receive coatings.

D. Relocate to original position equipment and fixtures that have been moved to allow application of coatings.

E. Remove protective materials.

3.6 PROTECTION AND REPAIR

A. Protect completed coating applications from damage by subsequent construction activities until completion of painting project.

B. Touch-up coatings damaged by subsequent construction activities.

THE FOLLOWING STATEMENTS MUST BE INCLUDED WITH SUBMITTAL EXACTLY AS STATED BELOW. DO NOT REMOVE OR MODIFY.

All references to (0 g/L) are Zero VOCs according to EPA Method 24.

The CERTIFIED ASTHMA & ALLERGY FRIENDLY Mark is a Registered Certification Mark of the ASTHMA AND ALLERGY FOUNDATION OF AMERICA and ALLERGY STANDARDS, LTD. Cradle to Cradle Certified™ is a certification mark licensed by the Cradle to Cradle Products Innovation Institute. These products are not endorsed by or a division of CHPS. These products are provided by Benjamin Moore & Co., not CHPS.

SECTION 105500 - POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Apartment mailboxes.

1.2 REFERENCES

A. Architectural and Transportation Barriers Compliance Board (ATBCB): Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).

B. United States Postal Service (USPS):
1. USPS-STD-4C - United States Postal Service Standard 4C, Wall-Mounted Centralized Mail Receptacles.SUBMITTALS
2. USPS-STD-4B+ - United States Postal Service Standard 4B+, Receptacles, Apartment House, Mail; modified.

C. Product Data: For each product indicated.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

E. Samples: For each exposed finish.

F. Product certificates, including written approval by Postmaster General.

G. Maintenance data.

H. Other Informational Submittals: Final USPS local postmaster approval for installed postal specialties to be served by USPS.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Provide manufacturer's standard catalog data for specified products.

C. Shop Drawings: Prepared specifically for this project; show dimensions of mail boxes, wall cuts, and interface with other products.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.4 REGULATORY REQUIREMENTS

A. Comply with USPS-STD-4C for wall-mounted centralized mailboxes.

B. Comply with Americans with Disabilities Act Accessibility Guidelines (ADAAG).

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have a Quality System in place to ensure and be able to substantiate that manufactured units conform to requirements and match the approved design.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspect the materials upon delivery to ensure that specified products have been received.

B. Store materials protected from exposure to harmful weather conditions.

C. Handle materials to prevent damage or marring of finish.

D. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Key Blanks: Furnish not less than 4 for every locks or fraction thereof, of each type of compartment door lock installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

B. Acceptable Manufacturer: Auth Florence

C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 CLUSTER BOX UNITS

A. Front-Loading Mailboxes: USPS approved; Cluster Box Unit 4CET8-13 Tenant doors equipped with five-pin cylinder lock cam with dust and rain shield. F-Spec as manufactured by Auth Florence

1. Size: See drawings.

2. Available Products:

a. Auth-Florence Manufacturing Co., A Florence Company; 1250 Series.

3. Concealed Components and Mounting Frames: Aluminum or steel sheet.

B. Directory: Surface-mounted, front-opening unit, with clear glass or plastic window. Fabricate frame from same material and finish as compartment doors and frames of vertical apartment mailboxes, unless otherwise indicated. Provide name strips made of 1/4-inch- high label tape.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, and as follows:

1. Sheet and Plate: ASTM B 209.
2. Extruded Shapes: ASTM B 221.

2.4 FABRICATION

A. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs, and safe to touch.

B. Form joints exposed to weather to exclude water penetration.

C. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation.

2.5 FINISHES

A. Aluminum Baked-Enamel Finish: Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system with a minimum dry film thickness of 1.5 mils, medium gloss.

2. Finish color to be selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Metal Protection: Where aluminum and copper alloys will contact grout, concrete, masonry, wood, or dissimilar metals, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation.

B. Final acceptance depends on compliance with USPS requirements.

C. Vertical Apartment Mailboxes: Install vertical apartment mailboxes with center of master lock cylinder not more than 58 inches and not less than 30 inches above finished floor.

1. Arrange compartments in groups, with not more than seven and not less than three compartments operated by one master lock.

D. Collection Boxes: Install collection boxes with bottom of mail slots not more than 60 inches above finished floor.

E. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.2 FIELD QUALITY CONTROL

A. Arrange for USPS personnel to test collection boxes after installation according to USPS regulations.

B. Obtain written final approval from USPS postmaster that authorizes mail collection.

END OF SECTION 105500

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SECTION 108010 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Toilet and bath accessories.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use room and product designations indicated on Drawings.

1.3 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace mirrors that develop visible silver spoilage defects within 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: The design for toilet and bath accessories described in Part 2 are based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Toilet and Bath Accessories:
   a. Robern
   b. Kohler
   c. American Standard

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, ASTM B 16, or ASTM B 30 castings.

C. Steel Sheet: ASTM A 366/A 366M, 0.0359-inch minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

J. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

K. Medium Bronze: US5 Antique Brass

2.3 TOILET AND BATH ACCESSORIES

Note: See Drawing FIXTURE AND APPLIANCE SCHEDULE.

A. UFAS UNIT Grab Bars:

1. Basis-of-Design Product: Accessible Environments, Elcoma Product #01-2212
2. Material: Stainless steel, 0.05 inch thick.
3. Size: 36” & 42”
4. Mounting: Concealed.
5. Gripping Surfaces: Smooth, satin finish.
6. Outside Diameter: 1-1/2 inches for heavy-duty applications.

B. Shower Curtain Rod:

1. Basis-of-Design: Bobrick, B-207
2. Stainless-steel shower curtain rod with 3-inch stainless-steel flanges designed for exposed fasteners, in length required for shower opening indicated.
3. Type: Normal-duty, 1-inch OD; fabricated from nominal 0.0375-inch- thick stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 108010

SECTION 113000 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cooking equipment including ranges, microwave ovens with integral exhaust hood.
2. Refrigerator/freezers.
3. Dishwasher.

1.2 SUBMITTALS

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

B. Samples: For each exposed finish.

C. Appliance Schedule: Use same designations indicated on Drawings.

D. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. 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. Gas-Burning Appliances: Comply with ANSI Z21 Series standards.

D. Residential Appliances: Comply with NAECA standards.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
1. Microwave Oven: Five-year limited warranty for in-home service defects in the magnetron tube.
2. Refrigerator/Freezer: Five-year limited warranty for in-home service on the sealed refrigeration system.

3. Dishwasher: 10-year warranty for in-home service against deterioration of tub and door liner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2. Products: Subject to compliance with requirements, provide one of the products specified. All appliances to be Energy Star and ADA compliant.

3. Basis-of-Design Product: The design for each residential appliance is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

4. List of Manufacturers:
See FIXTURE AND APPLIANCE SCHEDULE.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

END OF SECTION 113000

SECTION 123560 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Kitchen cabinets.
2. Vanity cabinets.

1.2 SUBMITTALS

A. Product Data: For cabinets and cabinet hardware.

B. Shop Drawings: For cabinets and countertops (by other section). Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

1.3 QUALITY ASSURANCE

A. Quality Standards: Unless otherwise indicated, comply with the following standards:

1. Cabinets: KCMA A161.1.

a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semi-exposed location.

1.4 FORMALDEHYDE STANDARDS

A. Low / No Formaldehyde Emissions:
1. All composite wood products (plywood, OSB, MDF, cabinetry, etc.) must be certified as compliant with California 93120 Phase 2

PART 2 - PRODUCTS

2.1 CABINET MATERIALS

A. General:
1. Hardwood Lumber: Kiln dried to 7 percent moisture content.
2. Softwood Lumber: Kiln dried to 10 percent moisture content.

3. Hardwood Plywood: HPVA HP-1.
4. Particleboard: ANSI A208.1, Grade M-2
5. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
6. Hardboard: AHA A135.4, Class 1 Tempered.
7. Veneer or dimensional laminate
8. Laminate
9. Aluminum

B. Exposed Materials:

1. Full overlay cabinet doors and drawers (frameless).

    a. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color.
    b. Finish: As selected by Architect from manufacturer's full range.

2. White Laminate (Kitchen Cabinet interior).

3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.

    a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

C. Semi exposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces.
2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces.

D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.

2.2 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cabinet Exterior and Interior

    a. Brooklyn Woods

Casandra Charles, Program Cooridanator
718.389.3636
ccharles@bwiny.org

b. Advanta Cabinets

c. KOB Kitchen & Bath
Vermont Design Center
3910 Shelburne Road
Shelburne VT 05482
802.448.5500
www.kobkitchen.com

2.3 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: 5-1/2 inch long Poggenpohl B10, finish: Matte Chrome..

C. Hinges: European concealed soft close hinges for overlay doors.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.

E. Desktop Grommet: Satin chrome. Manufacurer, Doug Mockett & Co., Inc. 2 slot flush. 2-1/2” PS-2C.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

D. Fasten cabinets to adjacent units and to backing.
1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c., with toggle bolts through metal stud backing behind gypsum board.

E. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

END OF SECTION 123560

SECTION 220000 - GENERAL CONDITIONS FOR PLUMBING WORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 WORK INCLUDED

A. Work of this section includes all labor, materials, equipment, hoisting and rigging, scaffolding and services necessary to complete the Plumbing Work as shown on the drawings and specified herein, including, but not limiting to, the following:

1.3 NOTICE TO BIDDERS

A. The specifications and drawings are intended to serve jointly as a basis upon which the Contractor shall submit a contract price for the material and labor provisions.

B. When conflicts occur in the specifications or on the drawings or between either, provide the item of greater quantity or higher cost.

C. Provide all items of labor or materials not specifically indicated, but required to complete the intended installations.

D. Coordinate all work with that of other trades in order that conflicts in space locations do not occur.

E. Perform the work under this contract simultaneously with the work of other trades, so as not to delay the overall progress of the work.

F. This Contractor shall be responsible for his work until its completion and final acceptance and shall replace any of same, which may be damaged, lost or stolen, without additional cost to Owner.

1.4 CONTRACTOR’S RESPONSIBILITY

A. Contract drawings for plumbing work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, ducts, piping and approximate sizes and locations of equipment outlets. Plumbing trades shall follow these drawings in layout of their work, consult general construction, structural and electrical drawings to familiarize themselves with all conditions affecting their work, and shall verify spaces in which their work will be installed.

B. The Contractor shall be responsible for establishing grades and elevations, checking of all interfaces, and shall verify all dimensions and locations in the field prior to the start of any work and/or installation of equipment and piping. The Contractor shall, at his expense, perform all minor rerouting of piping around obstructions from new or existing construction whether or not such conditions are indicated on the plans. Minor

rerouting of piping is defined as any rerouting, which requires less than 10 linear feet of addition piping (measured along the centerline) over and above that shown on the drawings in order to avoid an obstruction. Such rerouting shall be performed with piping of a size equal to that shown on the original routing. Whenever an obstruction requires more than a minor rerouting as defined above, the Contractor shall report the condition to the A/E prior to that start of pipework or ductwork on the affected system. The Contractor shall be responsible for neglect of checking all elevations, clearances, dimensions and locations of piping and ductwork systems prior to the start of work on same.

C. The Contractor shall verify with the A/E, before bidding any item of piping or piping arrangement, which may be incomplete, incorrect or indefinite. After contract is let, the A/E's decision shall be final.

D. All trades shall cooperate and confer with each other as to locations of their materials and equipment before erecting work, so as to avoid interference as much as possible, and in such manner that will in no way retard progress of construction. In instances where interferences develop, the Contractor shall relocate the work as required by A/E, regardless of which work was installed first.

E. Additional and supplemental drawings may, from time to time, be furnished and the same when made are to constitute a part of the original contract drawings and will not depart materially there from.

F. The A/E specifically reserves the right, up to the time of roughing-in, to exactly define the position of the equipment to be installed and connected to and arrangement of these connections.

G. Special attention is called to the contract drawings and specifications involving general construction, electrical work and details thereon. Bidders are notified to carefully scrutinize these documents for the details affecting the performance of the plumbing trades.

1.5 DEFINITIONS

A. The following definitions of terms and expressions used in this section are in addition to listing given in General Conditions:

1. "A/E" shall mean "Architect and/or Engineer".
2. "Provide" shall mean, "furnish and install" unless otherwise indicated.
3. "Herein" shall mean the contents of a particular section where this term appears.
4. "Indicated" shall mean, "indicated on contract drawings".
5. "Scheduled" shall mean, "as scheduled on contract drawings".
6. "Concealed", where used in connection with insulation and painting of piping and accessories, shall mean that they are hidden from sight, as in trenches, chases, furred spaces, pipe shafts or hung ceilings.
7. "Exposed", where used in conjunction with insulation and painting of pipe and accessories, shall mean that they are not "concealed" as defined herein above.

8. “Singular Number”: In all cases where a device or part of the equipment or system is herein referred to in the singular number (such as pump or plumbing system), it is intended that such reference shall apply to as many such items as are required to complete the installation.

1.6 SITE INSPECTION

A. All bidders on this work shall visit the job site and become thoroughly familiar with the conditions under which the work will be performed. The submission of a proposal shall be construed as evidence that the bidder has visited the site and has knowledge conditions. Any later claim for extra payment because of difficulties encountered will not be allowed.

1.7 PROTECTION OF PERSONS AND PROPERTY

A. Safety Precautions and Programs

1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

B. Safety of Persons and Property

1. The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

a. All employees on the Work and all other persons who may be affected thereby;

b. All the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the contractor or any of the Contractor’s Subcontractors of Sub-subcontractors;

c. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

d. The work of the Owner or other separate contractors.

C. The Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety or persons or property or their protection from damage, injury or loss.

D. The Contractor shall erect and maintain, as required by existing conditions and the progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

E. The Contractor shall promptly remedy all damage or loss to any property caused in whole or in part by the Contractor, any Subcontractor, any Sub-contractor, anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and for which the Contractor is responsible.

F. The Contractor shall designate a responsible member of the contractor's organization at the site whose duty shall be the prevention of accidents.

1.8 SCHEDULE OF WORK

A. Schedule all work to conform to the job progress schedule as submitted to and approved by the A/E.

1.9 SUBMITTALS

A. Approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and shall clearly identify equipment being submitted.

C. A minimum period of ten (10) working days, exclusive of transmittal time, will be required in the Engineer's office each time a shop drawing, product data and/or samples is submitted for review. This time period must be considered by the Contractor when scheduling his work.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

E. Submittals shall be marked to show specification reference including the section and paragraph numbers.

F. Submit each section separately and include the following:

1. Information which conforms to contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. Submittals on all pump and fans shall be complete with performance curves marked with the design points. Additionally, submittals for any pumps or fans that are in series or parallel with other pumps or fans shall include compounded performance curves for analysis by the A/E.

3. Submittals on electrical equipment shall be complete with all power and control wiring diagrams.

G. Submit samples as directed of items called for in the specifications; samples of the materials which the manufacturer will actually ship shall be submitted for approval after award of contract and be properly labeled or identified.

H. Submit all shop drawings and submittals in PDF for Engineer's review.

1.10 SHOP DRAWINGS AND COMPOSITE DRAWINGS

A. The Contractor shall promptly prepare and submit all shop drawings required by the specifications, contract and contract drawings, and also all incidental shop drawings required for the proper performance of the work. The shop drawings shall illustrate fully the requirements of the specifications and the contract drawings, and shall accurately show quantities, kind of materials, methods of assembly and all data required for fabrication, erection and installation. The relationship to adjoining work, whether furnished under other subdivisions of this contract or by other contractors, shall be properly shown.

B. The Plumbing Contractor shall be responsible for coordinating the installation work of all the Plumbing Contractor (HVAC, Fire Protection and Electrical Work) by means of composite shop drawings as specified herein.

C. When necessary to eliminate conflicts, the Contractor shall revise shop drawings as required at no additional cost to the Owner.

D. The composite shop drawings shall be constituted in the following manner: Plumbing Contractor shall prepare a set of reproducible drawings or AutoCAD drawing files drawn to the scale of 3/8” = 1’-0”, indicating thereon all ductwork, major piping, plus structural and architectural background details. He shall deliver this set of drawings to the Contractor for Plumbing and Sprinkler who will draw his work to scale on the drawings. Then the Plumbing Contractor shall deliver this set of drawings to the Contractor for Electrical Work who will superimpose his work on the drawings. The specified order in which the Contractors impose their work on the drawings is not intended to grant priority to any one Contractor in the allocation of space.

E. Upon Contractor’s request, the Engineer shall provide a complete set of CAD files via email with Engineer’s firm name removed for Contractor’s use to prepare shop drawings. Contractor shall obtain Engineer’s release form and bear the cost for the CAD files. The Engineer shall be reimbursed at the rate quoted in contract documents for the CAD files prior to their release to the Contractor.

F. At the completion of this phase, the Contractor shall hold a coordination meeting with the other Contractors to eliminate any interference among the trades that the drawings indicate and to avoid any conflicts in installing the work. If the Contractors are unable to reach agreement on a matter of interference among the plumbing trades, the matter shall be submitted to the A/E for his binding decision. After the set of drawings has been coordinated and all necessary changes have been made, each Contractor shall sign the drawings, attesting to his agreement that all work is clear.

1.11 OPERATION, MAINTENANCE MANUALS AND INSTRUCTIONS

A. Furnish to the A/E six (6) bound and indexed copies of the final approved installation, operations and maintenance manuals.

B. Manual Contents:

1. The manual shall provide comprehensive detailed information on the approved installation, operation and use, troubleshooting, parts list, lubrication and periodic maintenance, together with the source of replacement parts and service for the

items of equipment and the systems covered, including electrical equipment, devices and systems.

2. Where items of equipment or system work in conjunction with one another, the interconnections shall be shown on a single sheet, folded out if necessary. A schematic wiring diagram and a description of operation shall be included.

3. Where separate items of equipment specified herein are combined into a single self-contained unit, the drawings and required data shall treat such item of equipment in such self-contained unit as separate items. Referring to such self-contained unit as one item of equipment will not be acceptable.

4. The manual shall also contain:

   a. Equipment capacity (input and output).

   b. Control data including calibration information, wiring diagrams, sequences of operation, schematics, desired and field determined setpoints permanently recorded on the control drawings, and any comments related to field changes to programming.

   c. A complete written narrative of how each system is intended to operate.

C. At the completion of the work, the Contractor shall instruct the employees who will have charge of the equipment in the care, adjustment and operation of each piece of equipment. Instruction shall be by competent representatives of the manufacturers involved with adequate time allowed for complete coverage of all owning and operating procedures.

D. In addition, the Contractor shall leave with such employees printed instructions covering the operation and required maintenance of each particular piece of equipment. Instructions shall be bound and titled and submitted to the A/E for approval. Submit six (6) sets.

1.12 AS-BUILT DRAWINGS

A. The Contractor shall furnish as-built drawings on CAD format to the A/E at completion of the job. Keep drawings current as work progresses.

B. Record all changes from installations originally indicated. Record final location of underground lines by depth from finished grade and by offset distances in feet and tenths to surface improvement such as building, curb, or edges of walks. Where work appears on two or more drawings, Contractor shall mark changes on all drawings. At completion, furnish the above required information to the A/E for approval and record. Drawings shall be certified to be “as-built” and signed by Contractor. Work shall not be accepted until such drawings have been delivered to the A/E.

C. Upon Contractor’s request, the Engineer shall provide a complete set of CAD files via email with Engineer’s firm name removed for Contractor’s use to prepare as-built drawings. Contractor shall obtain Engineer’s release form and bear the cost for the CAD files.

1.13 CODES AND STANDARDS

A. Work performed under this Contract shall conform to all applicable laws, ordinances, regulations, construction codes, energy codes (state, local and federal), and shall be subject to control of public authorities having jurisdiction.

B. Wherever requirements of such laws, codes, regulations differ from the drawings or specifications, they shall take precedence over the drawings specifications, and are expressly made part of the Contract, except where the drawings or specifications are more stringent or require better materials, which would also be acceptable to authorities (i.e., the more stringent code shall always apply).

C. Any portion of work which is not subject to the approval of an authority having jurisdiction shall be provided in accordance with National Fire Protection Association requirements.

D. Comply with applicable utility company rules and regulations.

E. Comply with Occupational Safety and Health Act (OSHA) requirements.

1.14 FEES AND PERMITS

A. The Contractor shall secure all permits and pay all fees required by local and state governing bodies necessary to complete the construction. Failure to investigate all applicable payments before the bid submission shall not constitute grounds for additional monies from the Owner. The Owner shall be furnished with all certificates of approval.

1.15 INSPECTIONS, PROGRESS INSPECTIONS, SPECIAL INSPECTIONS AND TESTING

A. The owner will hired directly an inspection agency to perform all required special inspections.

B. The following inspections, tests, progress inspections and special inspections shall be considered part of the contract work.

C. Upon completion or partial completion of the permitted plumbing work, inspections, progress inspections, special inspections and tests shall be conducted by approved agencies or special inspectors qualified to conduct such inspections and tests. Inspections and progress inspections shall be performed in compliance with Section BC 109 of the New York City Building Code and Chapter 5000 of the New York City Energy Conservation Code (1 RCNY §5000-01). Special Inspections shall be performed in compliance with Sections BC 1704 and BC 1707 of the New York City Building Code for all plumbing systems regulated by the New York City Plumbing Code. Refer to Article 116 of Chapter 1 of Title 28 of the Administrative Code for additional provisions related to inspections.

D. Inspections of plumbing systems shall include the following as applicable to the system:

1. Visual certification that required components of such systems are complete in accordance with the manufacturer's installation guidelines and the approved construction documents.
2. Supports, hangers, seismic bracing, and vibration isolation equipment are properly spaced and anchored to supporting structure.
3. Installation of required signage and safety instructions.
4. Electrical components are installed and electrical sign-off issued.
5. Required labeling, operational instructions and safety signage properly posted.
6. All related Special Inspections for such systems are complete.
7. Through-penetration fire stopping.

E. Upon completion of all special inspections, testing and building department sign-off, the plumbing contractor shall secure all certificates of compliance for equipment and transmit same to owner.

1.16 GUARANTEE

A. In addition to the requirements stated in the specifications, the Contractor must guarantee all equipment, materials and appurtenances installed by him to be free from all defects. Upon written notice from the A/E, the Contractor shall promptly correct all defects without additional cost to the Owner. The Contractor must make good, at his own expense, any defects in materials or workmanship that may appear. The guarantee period shall be from one (1) year after final inspection and acceptance of the project.

1.17 RELATED WORK IN OTHER CONTRACTS

A. The specifications for the overall construction delineate various items of work under separate contract headings. The list below sets forth this delineation to the extent that it affects the Plumbing work.

B. In the absence of more detailed information, this list shall be taken as a specific instruction to the plumbing trade to include the work assigned to it.

C. Indications that the plumbing trade is to perform an item of work mean that the work is part of its contract.

D. This listing shall not be used for the purpose of establishing trade union jurisdiction, but to establish under which contract such work is to be included. All trade union issues shall be the responsibility of the Contractor.

E. The Plumbing Contractor is required to supply all necessary supervision and coordination information to any other Contractors who are supplying work to accommodate the plumbing installations.

F. Where the plumbing trade is required to install items which it does not purchase, it shall include for such items.

1. The coordination of their delivery.
2. Delivery to site from bonded warehouse within 50 miles radius.
3. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.
4. Their safe handling and field storage up to the time of permanent placement in the project.
5. The correction of any damage, defacement or corrosion to which they may have been subjected.
6. Their field assembly and internal connection as may be necessary for their proper operation.
7. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
8. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them.

G. Items which are to be installed but not purchased as part of the work of the Plumbing Contractor shall be carefully examined by this trade upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the work of the Plumbing Contractor will be considered only if presented in writing within one week of

the date of delivery to the project of the items in question. The work of the Plumbing Contractor shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

"Plb" = Plumbing

"HVAC" = Heating, Ventilating and Air Conditioning

"Elec" = Electrical

"CM" = Construction Manager

"F" = Furnished

"I" = Installed

"P" = Provided (Furnished and Installed)

ITEM	PLB	HVAC	ELEC	CM	NOTES
Motors for plumbing equipment	P				
Motor controls and starters which are part of power circuit.	F		I		Specifications and drawings delineate detailed exceptions.
Motor controls which are not part of power circuit.	P				Specifications and drawings delineate detailed exceptions.
Power wiring for plumbing equipment.			P		
Temporary water.				P	
Temporary light and power.				P	
Temporary toilets.				P	
Hoisting	P				(Includes bracing and dunnage for safety rigging.)
Rigging	P				
Rough cutting, chasing and patching.	P				Cost where due to late installation or improper coordination of work is the responsibility of the delinquent trade.
Finish patching.				P	
Framed slots and openings in walls, decks and slabs.				P	Coordination drawings are required from plumbing trade.
Sleeves through non-membraned slabs, decks and walls.	P				
Waterproof sealing of sleeves through waterproof slabs, decks and fire rated walls.	P				
Fireproof sealing (fire safing excess opening spaces in	P				

ITEM	PLB	HVAC	ELEC	CM	NOTES
slabs, decks and fire rated walls).					
Concrete foundations, pads and bases inside buildings.	P				Furnishing of anchors and vibration mounts included in the plumbing trade.
Stands, supports and fastening of equipment	P				
Field touch-up painting of damaged shop coats.	P				
Field rustproofing of supporting steel members, frames and racks.	P				
Finish painting of exposed work.				P	Insulation coating are by plumbing trade.
Access doors in general construction.	P				
Ladders to plumbing equipment.	P				
Gas service piping to heating equipment.	P				
Rubbish removal.	P				Where one trade furnishes and another installs, the installing trade removes the shipping and packing materials which accumulate.
Testing and balancing.	P				
Special tools for equipment maintenance.	F				
Masonry shafts, sheet rock shafts.				P	It is mandatory to assure the airtightness of all joints, holes and other openings to make these air conveyors acceptable for their function.
Excavation and backfill.	P				

PART 2 - PRODUCTS

2.1 QUALITY OF MATERIALS AND SUBSTITUTIONS

A. Substituted equipment, where permitted, must conform to space requirements including required access space. Any substituted equipment that cannot meet space requirement shall be replaced at the Contractor's expense. A specific model and manufacturer of equipment may be used as a standard for producing the drawings.

Where the Contractor elects to use equipment specified other than used as a drawing standard or where the Contractor elects to use substitutes if approved, equipment other than that specified, any modifications of related systems (piping, etc.) or other trades (Electrical, HVAC, Structural, Architectural, etc.) or additional cost that results from this equipment shall be borne by this Contractor.

B. Where a specific model and manufacturer of equipment is specified, the Contractor shall provide what is specified without substitution. Where specified as “or approved equal”, the Contractor may substitute equipment except that the burden is upon the Bidder to prove such equality. If the bidder elects to prove such equality he must request the Owner's and A/E's approval in writing to substitute such item for the specified item, stating the cost difference involved with supporting data, and samples, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability, warranty and cost.

C. A submittal for a proposed substitution must include comparative data of all performance criteria contained in the specifications, schedules and drawings and alienate all differences between the proposed substitution and the specified equipment in terms of space requirements, access requirements, supports, piping connections, power wiring, controls and all other changes required to be made in other work including cost adjustment to accommodate the substituted equipment. The A/E reserves the right to reject a substitute based upon its compatibility with systems and special layouts or for any performance or construction criteria whether or not that criteria was outlined in the specifications and drawings.

2.2 PRODUCT HANDLING

A. In addition to the requirements of the General Conditions, the Contractor shall be responsible for the following:

1. Responsibility for care and protection of plumbing work rests with the Contractor until it has been tested and accepted.
2. After delivery, before, during and after installation, protect equipment and materials against theft, injury and damage for all causes.
3. Coat polished or plated metal part with Vaseline immediately after installation.
4. Protect equipment outlets and pipe, openings with caps.

B. The Contractor shall receive, properly house, handle, hoist, deliver to proper location, equipment and other materials required for the contract.

C. In the event of damage, immediately make all repairs and replacements necessary for the approval of the A/E and at no additional cost to the Owner.

2.3 MATERIALS

A. Design:

1. Unless otherwise specified, equipment or material of same type or classification, used for the same purpose, shall be products of the same manufacturer. All material shall be new and of the latest design of manufacturer providing equipment or materials.

2. Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ASME, or other applicable technical standards, suitable for maximum working pressure and shall have neat and finished appearance.

B. Electrical Characteristics:

1. It shall be the responsibility of this Contractor to ensure that the voltage and current characteristics of the electrical equipment furnished by him shall be suitable for the electrical services as specified.

C. Lubricating Devices:

1. Provide oil level gauges, grease cups, grease gun fittings for machinery bearings as recommended by machinery manufacturer; where lubricating means are not easily accessible, extend to accessible, extend to accessible locations. Furnish all grease gun fittings of uniform type.

PART 3 - EXECUTION

3.1 SUPERVISION

A. All work shall be performed by competent mechanics under supervision of an experienced erection supervisor. The Contractor shall, upon initiation of construction, keep a suitable force of men (including supervisory personnel) on the site at all times in order to place all sleeves, inserts, outlet boxes and fixtures, and provide all other openings as are required for the satisfactory installation of equipment.

3.2 COORDINATION

A. Contractor's attention is directed to scheduling of construction and time limitations for each phase of the work. Work shall be coordinated to permit proper setting of the work of other trades.

B. Where piping work and appurtenances are in place prior to completion of adjacent concrete and masonry work, they must be protected against damage and displacement until construction is completed.

3.3 CUTTING AND PATCHING

A. All cutting and patching associated with the installation of the plumbing work is the responsibility of the Contractor.

B. No cutting of bearing walls, beams, etc. shall be done without the approval of the A/E. All materials, patching and finishing, etc. shall match the surroundings. All cutting and patching shall be done by workman skilled in the trades and in the employ of the Contractor for the project. All cutting shall be done with the saw-type edges to give a neat and workmanlike appearance. All pipe holes shall be core drilled unless specified otherwise.

3.4 TEMPORARY OPENINGS

A. All necessary temporary openings not indicated which may be required for purpose of bringing equipment into building shall be provided as required subject to the approval of the A/E. The Contractor shall perform work of providing and maintaining openings and of restoring structure.

B. Holes provided in General Construction work to permit installation of lines for temporary plumbing services shall, after removal of such lines, be patched as specified.

3.5 CLEAN-UP

A. The Contractor shall be held responsible for the general clean-up of all areas affected by the work in the Contract. All rubbish and accumulative material shall be removed from the premises and the premises left “broom clean” upon completion.

3.6 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping: Prohibited in electric room and closets, telephone rooms and closets, elevator machine rooms, and shall not be installed within 5 feet of transformers, substations, switchboards, motor control center, standby power plant, motors.

B. If 5 foot minimum is totally unavoidable, provide sleeve drained outside of electrical equipment room where approved by A/E. In no case however, shall piping be installed above electrical equipment described above.

3.7 TESTING, ADJUSTING AND BALANCING

A. Make all required adjustments to air or hydronic system devices until all specified performances are met. Prior to testing clean and comb all coils as required. Before commencement of construction, test existing equipment to establish output, etc. Submit certified reports indicating outlet cfm, motor and compressor amperage draw, rpm, static pressure, outdoor temperature at time of test, return air, mixed air, discharge air and setting of all controllers.

B. Water system balancing shall be performed by an organization specializing in system balancing and procedures having at least five (5) years’ experience.

3.8 SUPPORTS, HOUSEKEEPING PADS AND STANDS

A. Where supports, stands and suspended platforms for machinery, tanks or other equipment are indicated or specified in plumbing work sections, perform as follows:

1. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected, and to distribute properly the load and impact over building areas. Conform to applicable technical societies’ standards, also to codes and regulations of agencies having jurisdiction.
2. Locate supports for tanks so as to avoid undue strain on shell and interference with pipe connections to tank outlets.
3. For tanks containing tubes, check support locations for clearances to pull tubes.

4. Mount power-driven equipment on common base with driver, unless otherwise indicated, specified or approved.

5. Submit detailed shop drawings of all supports; obtain approval before fabricating and constructing.

B. Housekeeping Pads:

1. Provide concrete housekeeping pads for all floor mounted equipment. Use concrete mix reinforcement where required.

a. Where floor is water proofed, construct foundation so that anchor bolts will not pierce waterproofing.

b. Finished exposed parts of foundation with cement mortar; fill voids, trowel smooth, bevel edges and corners to make neat appearances; use cement hardener; paint to match finished floor.

c. Unless indicated otherwise provide housekeeping pads for all floor-mounting equipment. Pad dimensions, size of foundation bolts, methods of setting, aligning and anchoring of equipment shall be as recommended by manufacturer of equipment and as approved. Make minimum height above finished floor 4” and extend outer edges 6” minimum beyond machinery bed-plate. Submit shop drawings for approval.

d. For machinery on pad, provide foundation bolts, sleeves, washers, nuts and templates to locate position on bolts. Make sleeves of steel pipe; finish flush with top of rough concrete. For anchorage, make embedded end of bolts hooked, or threaded with nut and square plate.

e. Provide 1” thick grouting between machinery base plate and concrete pad; fill completely the space between them. Clean top of pad; wet if before grouting. Do not remove leveling wedges before grout reaches its final set. Fill voids left by removal of wedges with grout to make neat appearance.

C. Floor Stands:

1. Unless otherwise indicated, where equipment is indicated or specified to floor mounted on stands or legs, construct of structural steel members or steel pipe and fittings; brace and fasten with flanges bolted to floor.

D. Suspension Support for Pipes Equipment:

1. Unless otherwise indicated, all pipes, ducts and equipment that are suspended shall be connected directly to the building steel. Where hangers are required between building steel points, supplementary steel members shall be added by the Contractor as required to adequately support the load.

2. Pipes shall not be supported from other pipes or equipment.

3.9 PAINTING AND FINISHING

A. Except as specified herein, the finished painting of Plumbing Work within the building and on the roof shall be as specified in Architectural Drawings and Specifications.

B. All plumbing equipment shall have a factory applied prime and finish coat of paint. Galvanized surfaces shall be considered as finished surfaces for equipment rooms and items concealed from view. All items of equipment marred or rusted, even though factory finished, shall be repainted.

C. All welded pipe connections, supports and stands shall be painted with an approved rust inhibitor (“extend” by Permatex or equal) prior to insulating.

3.10 FIRE-STOP PROTECTION

A. Where pipes and conduit pass through fire partitions, fire walls or floors, install a firestop that provides and effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight, and completely fill clearances between pipe and sleeves. Provide escutcheon plates on both sides of all rated construction.

B. Fire-stopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke and gases. Fire-stopping material shall be non-combustible as defined by ASTM E136.

3.11 ACCESS PANELS

A. The Contractor shall furnish access panels for the installation by the Contractor for General Construction for concealed valves, expansion joints, valves, traps, strainers, dampers and other parts requiring accessibility for operation and maintenance.

B. Access panel size shall be as indicated; when not indicated, make 18” x 18” minimum or larger as directed or required.

C. Frames shall be 16 gauge steel.

D. Access panels for use on masonry, tile, drywall shall have frames with flanges to hide rough openings in walls. Style M as manufactured by Milcor, or approved equal.

E. When access panels or doors are installed in fire-rated construction they shall be fire rated to match the construction.

3.12 ELECTRICAL WIRING DIAGRAMS

A. Electrical wiring for automatic temperature, safety an interlocking controls for motors, motor starters and other electrical apparatus and devices shall be provided by this Contractor, except for wiring of fractional horsepower fan motors which shall be by the Electrical Contractor. Power wiring will be under another Division.

B. Prepare and submit for approval terminal point to terminal point completely coordinated and integrated wiring diagrams for all wiring.

C. Submit specific wiring diagrams or factory-installed equipment wiring.

END OF SECTION 220000

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves
2. Bronze ball valves
3. Iron, single-flange butterfly valves
4. Bronze swing check valves
5. Iron swing check valves
6. Iron swing check valves with closure control
7. Bronze gate valves
8. Iron gate valves
9. Bronze globe valves
10. Iron globe valves
11. Chainwheels

B. Related Sections (where applicable):

1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
3. Section 221119 "Domestic Waste Piping Specialties" for valves applicable only to this piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 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. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

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.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Kitz Corporation
2. Description:
   a. Standard: MSS SP-110
   b. CWP Rating: 400 psig
   c. Body Design: One piece
   d. Body Material: Forged brass
   e. Ends: Threaded
   f. Seats: PTFE or TFE
   g. Stem: Brass
   h. Ball: Chrome-plated brass
   i. Port: Reduced

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Crane Co.; Crane Valve Group; Crane Valves
    b. Crane Co.; Crane Valve Group; Jenkins Valves
    c. DynaQuip Controls
    d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
    e. Hammond Valve
    f. Jamesbury; a subsidiary of Metso Automation
    g. Jomar International, LTD
    h. Kitz Corporation
    i. Legend Valve
    j. Marwin Valve; a division of Richards Industries
    k. Milwaukee Valve Company
    l. NIBCO INC.
    m. Red-White Valve Corporation
    n. RuB 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: Forged brass
    f. Ends: Threaded
    g. Seats: PTFE or TFE
    h. Stem: Brass
    i. Ball: Chrome-plated brass
    j. Port: Full

C. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Hammond Valve
    b. Jamesbury; a subsidiary of Metso Automation
    c. Legend Valve
    d. Marwin Valve; a division of Richards Industries

e. Milwaukee Valve Company

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: Forged brass

f. Ends: Threaded

g. Seats: PTFE or TFE

h. Stem: Brass

i. Ball: Chrome-plated brass

j. Port: Regular

2.3 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.

b. Conbraco Industries, Inc.; Apollo Valves

c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110

b. CWP Rating: 400 psig

c. Body Design: One piece

d. Body Material: Bronze

e. Ends: Threaded

f. Seats: PTFE or TFE

g. Stem: Bronze

h. Ball: Chrome-plated brass

i. Port: Reduced

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.

b. Conbraco Industries, Inc.; Apollo Valves

c. Crane Co.; Crane Valve Group; Crane Valves
d. Hammond Valve
e. Lance Valves; a division of Advanced Thermal Systems, Inc.
f. Legend Valve
g. Milwaukee Valve Company
h. NIBCO INC.
i. Red-White Valve Corporation
j. 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: Bronze
i. Ball: Chrome-plated brass
j. Port: Full

C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves
c. Crane Co.; Crane Valve Group; Jenkins Valves
d. Crane Co.; Crane Valve Group; Stockham Division
e. DynaQuip Controls
f. Hammond Valve
g. Lance Valves; a division of Advanced Thermal Systems, Inc.
h. Milwaukee Valve Company
i. NIBCO 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: Bronze

i. Ball: Chrome-plated brass

j. Port: Regular

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.

b. Conbraco Industries, Inc.; Apollo Valves

c. Cooper Cameron Valves; a division of Cooper Cameron Corporation

d. Crane Co.; Crane Valve Group; Jenkins Valves

e. Crane Co.; Crane Valve Group; Stockham Division

f. DeZurik Water Controls

g. Flo Fab Inc.

h. Hammond Valve

i. Kitz Corporation

j. Legend Valve

k. Milwaukee Valve Company

l. NIBCO INC.

m. Norriseal; a Dover Corporation company

n. Red-White Valve Corporation

o. Spence Strainers International; a division of CIRCOR International, Inc.

p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I

b. CWP Rating: 200 psig

c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron

e. Seat: EPDM

f. Stem: One- or two-piece stainless steel

g. Disc: Aluminum bronze

B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.

b. Conbraco Industries, Inc.; Apollo Valves

c. Cooper Cameron Valves; a division of Cooper Cameron Corporation

d. Crane Co.; Crane Valve Group; Jenkins Valves

e. Crane Co.; Crane Valve Group; Stockham Division

f. DeZurik Water Controls

g. Flo Fab Inc.

h. Hammond Valve

i. Kitz Corporation

j. Legend Valve

k. Milwaukee Valve Company

l. NIBCO INC.

m. Norriseal; a Dover Corporation company

n. Red-White Valve Corporation

o. Spence Strainers International; a division of CIRCOR International, Inc.

p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I

b. CWP Rating: 200 psig

c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron

e. Seat: NBR

f. Stem: One- or two-piece stainless steel

g. Disc: Aluminum bronze

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.

b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves
d. Cooper Cameron Valves; a division of Cooper Cameron Corporation
e. Crane Co.; Crane Valve Group; Center Line
f. Crane Co.; Crane Valve Group; Stockham Division
g. DeZurik Water Controls
h. Flo Fab Inc.
i. Hammond Valve
j. Kitz Corporation
k. Legend Valve
l. Milwaukee Valve Company
m. Mueller Steam Specialty; a division of SPX Corporation
n. NIBCO INC.
o. Norriseal; a Dover Corporation company
p. Spence Strainers International; a division of CIRCOR International, Inc.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
   a. Standard: MSS SP-67, Type I
   b. CWP Rating: 200 psig.
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron
   e. Seat: EPDM
   f. Stem: One- or two-piece stainless steel
   g. Disc: Nickel-plated or -coated ductile iron

D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
   b. American Valve, Inc.
   c. Conbraco Industries, Inc.; Apollo Valves
   d. Cooper Cameron Valves; a division of Cooper Cameron Corporation
   e. Crane Co.; Crane Valve Group; Center Line
   f. Crane Co.; Crane Valve Group; Stockham Division

g. DeZurik Water Controls
h. Flo Fab Inc.
i. Hammond Valve
j. Kitz Corporation
k. Legend Valve
l. Milwaukee Valve Company
m. Mueller Steam Specialty; a division of SPX Corporation
n. NIBCO INC.
o. Norriseal; a Dover Corporation company
p. Spence Strainers International; a division of CIRCOR International, Inc.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
a. Standard: MSS SP-67, Type I
b. CWP Rating: 200 psig
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron
e. Seat: NBR
f. Stem: One- or two-piece stainless steel
g. Disc: Nickel-plated or -coated ductile iron

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves
c. Crane Co.; Crane Valve Group; Jenkins Valves
d. Crane Co.; Crane Valve Group; Stockham Division
e. Hammond Valve
f. Kitz Corporation
g. Milwaukee Valve Company
h. NIBCO INC.
i. Powell Valves
j. Red-White Valve Corporation

k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3

b. CWP Rating: 200 psig

c. Body Design: Horizontal flow

d. Body Material: ASTM B 62, bronze

e. Ends: Threaded

f. Disc: Bronze

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves

b. Crane Co.; Crane Valve Group; Jenkins Valves

c. Crane Co.; Crane Valve Group; Stockham Division

d. Hammond Valve

e. Kitz Corporation

f. Milwaukee Valve Company

g. NIBCO INC.

h. Red-White Valve Corporation

i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4

b. CWP Rating: 200 psig

c. Body Design: Horizontal flow

d. Body Material: ASTM B 62, bronze

e. Ends: Threaded

f. Disc: PTFE or TFE

2.6 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves

b. Crane Co.; Crane Valve Group; Jenkins Valves

c. Crane Co.; Crane Valve Group; Stockham Division
d. Hammond Valve
e. Kitz Corporation
f. Legend Valve
g. Milwaukee Valve Company
h. NIBCO INC.
i. Powell Valves
j. Red-White Valve Corporation
k. Sure Flow Equipment Inc.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:
   a. Standard: MSS SP-71, Type I
   b. CWP Rating: 200 psig
   c. Body Design: Clear or full waterway
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged
   f. Trim: Bronze
   g. Gasket: Asbestos free

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves
      b. Crane Co.; Crane Valve Group; Stockham Division
   2. Description:
      a. Standard: MSS SP-71, Type I
      b. CWP Rating: 200 psig
      c. Body Design: Clear or full waterway
      d. Body Material: ASTM A 126, gray iron with bolted bonnet
      e. Ends: Flanged
      f. Trim: Composition
      g. Seat Ring: Bronze
      h. Disc Holder: Bronze
      i. Disc: PTFE or TFE
      j. Gasket: Asbestos free

2.7 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. NIBCO INC.
2. Description:
    a. Standard: MSS SP-71, Type I
    b. CWP Rating: 200 psig
    c. Body Design: Clear or full waterway
    d. Body Material: ASTM A 126, gray iron with bolted bonnet
    e. Ends: Flanged
    f. Trim: Bronze
    g. Gasket: Asbestos free
    h. Closure Control: Factory-installed, exterior lever and spring

B. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Crane Co.; Crane Valve Group; Crane Valves
    b. Crane Co.; Crane Valve Group; Jenkins Valves
    c. Crane Co.; Crane Valve Group; Stockham Division
    d. Hammond Valve
    e. Milwaukee Valve Company
    f. NIBCO INC.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
    a. Standard: MSS SP-71, Type I
    b. CWP Rating: 200 psig
    c. Body Design: Clear or full waterway
    d. Body Material: ASTM A 126, gray iron with bolted bonnet
    e. Ends: Flanged
    f. Trim: Bronze
    g. Gasket: Asbestos free
    h. Closure Control: Factory-installed, exterior lever and weight

2.8 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves
    c. Crane Co.; Crane Valve Group; Jenkins Valves
    d. Crane Co.; Crane Valve Group; Stockham Division
    e. Hammond Valve
    f. Kitz Corporation
    g. Milwaukee Valve Company
    h. NIBCO INC.
    i. Powell Valves
    j. Red-White Valve Corporation
    k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    l. Zy-Tech Global Industries, Inc.
2. Description:
    a. Standard: MSS SP-80, Type 1
    b. CWP Rating: 200 psig
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded or solder joint
    e. Stem: Bronze
    f. Disc: Solid wedge; bronze
    g. Packing: Asbestos free
    h. Handwheel: Malleable iron, bronze, or aluminum

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves
    c. Crane Co.; Crane Valve Group; Jenkins Valves
    d. Crane Co.; Crane Valve Group; Stockham Division
    e. Hammond Valve
    f. Kitz Corporation
    g. Milwaukee Valve Company

h. NIBCO INC.
i. Powell Valves
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.

2. Description:
a. Standard: MSS SP-80, Type 2
b. CWP Rating: 200 psig
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint
e. Stem: Bronze
f. Disc: Solid wedge; bronze
g. Packing: Asbestos free
h. Handwheel: Malleable iron, bronze, or aluminum

2.9 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves
b. Crane Co.; Crane Valve Group; Jenkins Valves
c. Crane Co.; Crane Valve Group; Stockham Division
d. Flo Fab Inc.
e. Hammond Valve
f. Kitz Corporation
g. Legend Valve
h. Milwaukee Valve Company
i. NIBCO INC.
j. Powell Valves
k. Red-White Valve Corporation
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.
2. Description:
a. Standard: MSS SP-70, Type I
b. CWP Rating: 200 psig
c. Body Material: ASTM A 126, gray iron with bolted bonnet

d. Ends: Flanged

e. Trim: Bronze

f. Disc: Solid wedge

g. Packing and Gasket: Asbestos free

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves

b. Crane Co.; Crane Valve Group; Jenkins Valves

c. Crane Co.; Crane Valve Group; Stockham Division

d. Flo Fab Inc.

e. Hammond Valve

f. Kitz Corporation

g. Legend Valve

h. Milwaukee Valve Company

i. NIBCO INC.

j. Powell Valves

k. Red-White Valve Corporation

l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I

b. CWP Rating: 200 psig

c. Body Material: ASTM A 126, gray iron with bolted bonnet

d. Ends: Flanged

e. Trim: Bronze

f. Disc: Solid wedge

g. Packing and Gasket: Asbestos free

2.10 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves

b. Crane Co.; Crane Valve Group; Stockham Division

c. Hammond Valve
d. Kitz Corporation
e. Milwaukee Valve Company
f. NIBCO INC.
g. Powell Valves
h. Red-White Valve Corporation
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
j. Zy-Tech Global Industries, Inc.

2. Description:
a. Standard: MSS SP-80, Type 1
b. CWP Rating: 200 psig
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint
e. Stem and Disc: Bronze
f. Packing: Asbestos free
g. Handwheel: Malleable iron, bronze, or aluminum

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves
b. Crane Co.; Crane Valve Group; Stockham Division
c. NIBCO INC.
d. Red-White Valve Corporation

2. Description:
a. Standard: MSS SP-80, Type 2
b. CWP Rating: 200 psig
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint
e. Stem: Bronze
f. Disc: PTFE or TFE
g. Packing: Asbestos free
h. Handwheel: Malleable iron, bronze, or aluminum

2.11 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Crane Co.; Crane Valve Group; Crane Valves
    b. Crane Co.; Crane Valve Group; Jenkins Valves
    c. Crane Co.; Crane Valve Group; Stockham Division
    d. Hammond Valve
    e. Kitz Corporation
    f. Milwaukee Valve Company
    g. NIBCO INC.
    h. Powell Valves
    i. Red-White Valve Corporation
    j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    k. Zy-Tech Global Industries, Inc.
2. Description:
    a. Standard: MSS SP-85, Type I
    b. CWP Rating: 200 psig
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged
    e. Trim: Bronze
    f. Packing and Gasket: Asbestos free

2.12 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
    1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
    2. Attachment: For connection to butterfly valve stems.
    3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.
    4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 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. Do not install valves in inverted position.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for butterfly, gate and globe valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

1. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.2 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.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Throttling Service: Globe or ball or butterfly, ball, or butterfly valves.
3. Pump-Discharge Check Valves:
    a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
    c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class 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 ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc
3. Ball Valves: One or Two piece, full, regular or reduced port, brass or bronze with brass or bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze disc
5. Bronze Gate Valves: Class 125, NRS
6. Bronze Globe Valves: Class 125, bronze disc

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM or NBR seat, aluminum-bronze or ductile-iron disc.
3. Iron Swing Check Valves: Class 125, metal or nonmetallic-to-metal seats
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring weight.
5. Iron Gate Valves: Class 125, NRS or OS&Y
6. Iron Globe Valves: Class 125

END OF SECTION 220523

SECTION 220529 - HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer (where required by authorities having jurisdiction). Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel 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.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig, ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 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 or stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-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

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal 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 the building structure. Install retention straps as required.

B. Metal 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 for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. 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.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, 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 that 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 to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by 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 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.
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 or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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 bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 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/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 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 1-1/2 inches.

3.5 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 a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting.", Section 099123 "Interior Painting." And Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are 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 carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. 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 up to 1050 deg F, pipes NPS 4 to NPS 24, 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 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. 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 or carbon-steel plate.
7. 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 or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. 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 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. 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.

M. 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. 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.
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. 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.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220716 - PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing equipment:

1. Domestic water heat exchangers
2. Domestic water converters

B. Related Sections:

1. Section 220719 "Plumbing Piping Insulation."

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail removable insulation at equipment connections and access panels.
4. Detail application of field-applied jackets.
5. Detail application at linkages of control devices.
6. Detail field application for each equipment type.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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 agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. 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.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel

b. Armacell LLC; AP Armaflex

c. K-Flex USA; Insul-Sheet and K-FLEX LS

F. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory-applied ASJ or FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg. F is 0.29 Btu x in./h x sq. ft. x deg. F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap

b. Johns Manville; MicroFlex

c. Knauf Insulation; Pipe and Tank Insulation

d. Manson Insulation Inc.; AK Flex

e. Owens Corning; Fiberglas Pipe and Tank Insulation

G. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armacell LLC; Tubolit

b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote

2.3 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 and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal

b. Armacell LLC; Armaflex 520 Adhesive

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75

d. K-Flex USA; R-373 Contact Adhesive

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127

b. Eagle Bridges - Marathon Industries; 225

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70

d. Mon-Eco Industries, Inc.; 22-25

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82

b. Eagle Bridges - Marathon Industries; 225

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50

d. Mon-Eco Industries, Inc.; 22-25

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 739, Dow Silicone

b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive

c. P.I.C. Plastics, Inc.; Welding Adhesive

d. Speedline Corporation; Polyco VP Adhesive

2. For indoor applications, use adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90

b. Vimasco Corporation; 749

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg. F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10
b. Eagle Bridges - Marathon Industries; 550
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50
d. Mon-Eco Industries, Inc.; 55-50
e. Vimasco Corporation; WC-1/WC-5
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg. F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg. F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 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.

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.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C 1136, Type II.

4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film

5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film

6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for equipment.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab

   b. Vimasco Corporation; Elastafab 894

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

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. Products: Subject to compliance with requirements, provide one of the following:
    a. Johns Manville; Zeston
    b. P.I.C. Plastics, Inc.; FG Series
    c. Proto Corporation; LoSmoke
    d. Speedline Corporation; SmokeSafe
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system or Color as selected by Architect.
4. Factory-fabricated tank heads and tank side panels.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. ABI, Ideal Tape Division; 428 AWF ASJ
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836
    c. Compac Corporation; 104 and 105
    d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ
2. Width: 3 inches
3. Thickness: 11.5 mils
4. Adhesion: 90 ounces force/inch in width
5. Elongation: 2 percent
6. Tensile Strength: 40 lbf/inch in width
7. 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. Products: Subject to compliance with requirements, provide one of the following:
    a. ABI, Ideal Tape Division; 491 AWF FSK.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    c. Compac Corporation; 110 and 111.
    d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches
3. Thickness: 6.5 mils
4. Adhesion: 90 ounces force/inch in width
5. Elongation: 2 percent
6. Tensile Strength: 40 lbf/inch in width
7. 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. Products: Subject to compliance with requirements, provide one of the following:
a. ABI, Ideal Tape Division; 370 White PVC tape
b. Compac Corporation; 130
c. Venture Tape; 1506 CW NS
2. Width: 2 inches
3. Thickness: 6 mils
4. Adhesion: 64 ounces force/inch in width
5. Elongation: 500 percent
6. Tensile Strength: 18 lbf/inch in width

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ABI, Ideal Tape Division; 488 AWF
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800
c. Compac Corporation; 120
d. Venture Tape; 3520 CW
2. Width: 2 inches
3. Thickness: 3.7 mils
4. Adhesion: 100 ounces force/inch in width
5. Elongation: 5 percent
6. Tensile Strength: 34 lbf/inch in width

E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape and Saran 560 Vapor Retarder Tape
2. Width: 3 inches
3. Film Thickness: 6 mils

4. Adhesive Thickness: 1.5 mils
5. Elongation at Break: 145 percent
6. Tensile Strength: 55 lbf/inch in width

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. ITW Insulation Systems; Gerrard Strapping and Seals
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs

B. Insulation Pins and Hangers:

1. 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.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers
      2) GEMCO; Perforated Base
      3) Midwest Fasteners, Inc.; Spindle
   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, Aluminum or Stainless steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) GEMCO; Nylon Hangers
      2) Midwest Fasteners, Inc.; Nylon Insulation Hangers
   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. 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.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers

      2) GEMCO; Peel & Press

      3) Midwest Fasteners, Inc.; Self Stick

   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

   c. Spindle: Copper- or zinc-coated, low-carbon steel, Aluminum or Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

   d. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel, aluminum or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; RC 150

      2) GEMCO; R-150

      3) Midwest Fasteners, Inc.; WA-150

      4) Nelson Stud Welding; Speed Clips

   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. 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.

   a. Manufacturers: Subject to compliance with requirements, provide one of the following:

      1) GEMCO

      2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. C & F Wire

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. 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

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item 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. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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 4 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. 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.

O. For above ambient services, do not install insulation to the following:
1. Testing agency labels and stamps
2. Nameplates and data plates
3. Manholes
4. Handholes

5. Cleanouts

3.3 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe, and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
5. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
6. Stagger joints between insulation layers at least 3 inches.
7. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
8. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
9. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.4 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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.

3.5 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.

C. Where PVDC jackets are indicated, install as follows:

1. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
2. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.6 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    a. Finish Coat Material: Interior, flat, latex-emulsion size

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate equipment that is not factory insulated.

C. Domestic water and domestic hot-water hydropneumatic tank insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick
2. Mineral-Fiber Pipe and Tank: 1 inch thick
3. Polyolefin: 1 inch thick

D. Domestic Hot-Water Storage Tank Insulation:

1. Mineral-Fiber Pipe and Tank: Of thickness to provide an R-value of 12.5.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

1. PVC, Color-Coded by System: 30 mils thick (where applicable).

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. PVC, Color-Coded by System: 30 mils thick (where applicable).

END OF SECTION 220716

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping
2. Domestic recirculating hot-water piping
3. Sanitary waste piping exposed to freezing conditions
4. Storm-water piping exposed to freezing conditions
5. Roof drains and rainwater leaders
6. Supplies and drains for handicap-accessible lavatories and sinks

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation"

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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 agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation 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. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pittsburgh Corning Corporation; Foamglas

2. Special-Shaped Insulation: ASTM C 552, Type III.

3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.

4. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.

5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA, Inc.; Aerocel

b. Armacell LLC; AP Armaflex

c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Fibrex Insulations Inc.; Coreplus 1200

b. Johns Manville; Micro-Lok

c. Knauf Insulation; 1000-Degree Pipe Insulation

d. Manson Insulation Inc.; Alley-K

e. Owens Corning; Fiberglas Pipe Insulation

2. Type I, 850 Deg. F (454 Deg. C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Armacell LLC; Tubolit

b. Nomaco Insulation; IMCOLOCK and NOMALOCK

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote

2.3 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. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg. F.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA, Inc.; Aeroseal

b. Armacell LLC; Armaflex 520 Adhesive

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75

d. K-Flex USA; R-373 Contact Adhesive

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127

b. Eagle Bridges - Marathon Industries; 225

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70

d. Mon-Eco Industries, Inc.; 22-25

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82
    b. Eagle Bridges - Marathon Industries; 225
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20
    d. Mon-Eco Industries, Inc.; 22-25
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dow Corning Corporation; 739, Dow Silicone
    b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive
    c. P.I.C. Plastics, Inc.; Welding Adhesive
    d. Speedline Corporation; Polyco VP Adhesive
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90

b. Vimasco Corporation; 749

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg. F.

4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

5. Color: White

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10

b. Eagle Bridges - Marathon Industries; 550

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50

d. Mon-Eco Industries, Inc.; 55-50

e. Vimasco Corporation; WC-1/WC-5

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg. F.

4. Solids Content: 60 percent by volume and 66 percent by weight.

5. Color: White

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76

b. Eagle Bridges - Marathon Industries; 405

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45

d. Mon-Eco Industries, Inc.; 44-05

e. Pittsburgh Corning Corporation; Pittseal 444

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Permanently flexible, elastomeric sealant.

4. Service Temperature Range: Minus 100 to plus 300 deg. F.

5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
   b. Eagle Bridges - Marathon Industries; 405
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44
   d. Mon-Eco Industries, Inc.; 44-05
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg. F.
5. Color: Aluminum
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg. F.
5. Color: White
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 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.
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.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab
   b. Vimasco Corporation; Elastafab 894

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Johns Manville; Zeston
   b. P.I.C. Plastics, Inc.; FG Series
   c. Proto Corporation; LoSmoke
   d. Speedline Corporation; SmokeSafe
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Architect.
4. 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.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.

b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.

c. RPR Products, Inc.; Insul-Mate.

2. Sheet and roll stock ready for shop or field sizing.

3. Finish and thickness are indicated in field-applied jacket schedules.

4. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick polysurlyn.

5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.

6. Factory-Fabricated Fitting Covers:

a. Same material, finish, and thickness as jacket

b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows

c. Tee covers

d. Flange and union covers

e. End caps

f. Beveled collars

g. Valve covers

h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836

c. Compac Corporation; 104 and 105

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ

2. Width: 3 inches
3. Thickness: 11.5 mils
4. Adhesion: 90 ounces force/inch in width
5. Elongation: 2 percent
6. Tensile Strength: 40 lbf/inch in width
7. 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. ABI, Ideal Tape Division; 491 AWF FSK
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827
   c. Compac Corporation; 110 and 111
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ
2. Width: 3 inches
3. Thickness: 6.5 mils
4. Adhesion: 90 ounces force/inch in width
5. Elongation: 2 percent
6. Tensile Strength: 40 lbf/inch in width
7. 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. ABI, Ideal Tape Division; 370 White PVC tape
   b. Compac Corporation; 130
   c. Venture Tape; 1506 CW NS
2. Width: 2 inches
3. Thickness: 6 mils
4. Adhesion: 64 ounces force/inch in width
5. Elongation: 500 percent
6. Tensile Strength: 18 lbf/inch in width

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 488 AWF
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800
c. Compac Corporation; 120
d. Venture Tape; 3520 CW

2. Width: 2 inches
3. Thickness: 3.7 mils
4. Adhesion: 100 ounces force/inch in width
5. Elongation: 5 percent
6. Tensile Strength: 34 lbf/inch in width

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. ITW Insulation Systems; Gerrard Strapping and Seals
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. C & F Wire

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Engineered Brass Company
   b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products
   c. McGuire Manufacturing
   d. Plumberex
   e. Truebro; a brand of IPS Corporation
   f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

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

a. Truebro; a brand of IPS Corporation

b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 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.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. 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, according to insulation material manufacturer's written instructions, 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.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. 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.

P. For above-ambient services, do not install insulation to the following:

1. Testing agency labels and stamps

2. Nameplates and data plates
3. Cleanouts

3.3 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 Section 078413 "Penetration 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 Section 078413 "Penetration Firestopping."

3.4 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. 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. 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. 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. 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. 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.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, 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 cut sections of cellular-glass block insulation of same thickness as pipe 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. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. 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.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

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. Instead, 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.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Seal split-tube 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 polyolefin 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 polyolefin 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 cut sections of polyolefin pipe and sheet insulation to valve body.
   2. 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.

3.9 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. 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.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water: ½” thick for piping up to 1-1/2” D and 1” thick for piping 1-1/2” D and over.

1. Flexible elastometric
2. Mineral-Fiber, Preformed Pipe Insulation, Type I
3. Polyolefin

B. Domestic Hot and Recirculated Hot Water: Insulation shall be 1” thick for piping up to 1-1/2” D and 1-1/2” thick for piping 1-1/2” D and over.

1. Flexible Elastomeric.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I.
3. Polyolefin.

C. Stormwater: Insulation shall be1” thick.

1. Flexible Elastomeric.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I.
3. Polyolefin.

D. Roof Drain and Overflow Drain Bodies: Insulation shall be the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
3. Polyolefin: 1 inch thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC, Color-Coded by System: 30 mils thick.
2. Aluminum, Smooth, Corrugated or Stucco Embossed: 0.040 inch thick.

D. Piping, Exposed:
1. PVC, Color-Coded by System: 30 mils thick.
2. Aluminum, Smooth, Corrugated or Stucco Embossed: 0.040 inch thick.

END OF SECTION 220719

SECTION 220800 - COMMISSIONING OF PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. Each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. Startup reports shall be filed for record and submitted to the Commissioning Authority for review prior to and during functional performance testing.

D. The domestic water heating and domestic and process water pumping are to be commissioned including commissioning activities for the following specific items:
   1. Controls and all equipment items.
   3. Piping systems including pumps, valves and other components.
   4. Variable frequency drives.
   5. Documented balancing of hot water recirculation systems.
   6. Mixing valves.

END OF SECTION

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123
2. Cast-copper-alloy, hexagonal-stock body
3. Ball-and-socket, metal-to-metal seating surfaces
4. Solder-joint or threaded ends

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:

1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.

2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.

2. 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.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 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.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company; member of the Phoenix Forge Group
   b. Central Plastics Company
   c. Hart Industries International, Inc.
   d. Jomar International
   e. Matco-Norca
   f. McDonald, A. Y. Mfg. Co.
   g. Watts; a division of Watts Water Technologies, Inc.
   h. Wilkins; a Zurn company
2. Standard: ASSE 1079
3. Pressure Rating: 125 psig minimum at 180 deg. F or 150 psig (1035 kPa) or as required by system.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Capitol Manufacturing Company; member of the Phoenix Forge Group
   b. Central Plastics Company
   c. Matco-Norca
   d. Watts; a division of Watts Water Technologies, Inc.
   e. Wilkins; a Zurn company
2. Standard: ASSE 1079

3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg. F or 150 psig (1035 kPa) or as required by system.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company
d. Pipeline Seal and Insulator, Inc.
2. Non-conducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig or as required by system.
4. Gasket: Neoprene or phenolic
5. Bolt Sleeves: Phenolic or polyethylene
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Elster Perfection Corporation
b. Grinnell Mechanical Products; Tyco Fire Products LP
c. Matco-Norca
d. Precision Plumbing Products, Inc.
e. Victaulic Company
2. Standard: IAPMO PS 66
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg. F.
5. End Connections: Male threaded or grooved
6. Lining: Inert and noncorrosive, propylene

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. 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 for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting and at the base or head of each cold and hot water riser.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. 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.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 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. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: 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."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. 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.

H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

3.5 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, nipples and unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits or nipples.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

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 hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod
4. NPS 2-1/2: 108 inches with 1/2-inch rod
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod
6. NPS 6: 10 feet with 5/8-inch rod
7. NPS 8: 10 feet with 3/4-inch rod

E. Install supports for vertical copper tubing every 10 feet.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod
2. NPS 1-1/2: 108 inches with 3/8-inch rod
3. NPS 2: 10 feet with 3/8-inch rod
4. NPS 2-1/2: 11 feet with 1/2-inch rod
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod
7. NPS 6: 12 feet with 3/4-inch rod
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod

G. Install supports for vertical steel piping every 15 feet.

H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for 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 that required by plumbing code.

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.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. 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:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. 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.

c. 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.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 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 hot-water flow 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.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

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 described in either AWWA C651 or AWWA C652 or follow procedures 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. Repeat procedures if biological examination shows contamination.

e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K : wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 and larger, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

G. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; cast-or wrought-copper, solder-joint fittings; and brazed or soldered joints.

2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.

3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper push-on-joint fittings; and push-on joints.

H. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; cast- or wrought-copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; grooved-joint, copper-tube appurtenances; and grooved joints.

I. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; cast-or wrought-copper, solder-joint fittings; and brazed or soldered joints.
2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; grooved-joint, copper-tube appurtenances; and grooved joints.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers
2. Backflow preventers
3. Water pressure-reducing valves
4. Balancing valves
5. Temperature-actuated, electronic water mixing valves
6. Strainers
7. Hose bibbs
8. Wall hydrants
9. Drain valves
10. Water-hammer arresters
11. Trap-seal primer valves

B. Related Requirements (where applicable):

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 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 or Chrome plated

B. Hose-Connection Vacuum Breakers:
   1. Standard: ASSE 1011
   2. Body: Bronze, non-removable, with manual drain
   3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7
   4. Finish: Chrome or nickel plated, or Rough bronze

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:
   1. Standard: ASSE 1012
   2. Operation: Continuous-pressure applications
   3. Size: NPS 1/2 or NPS 3/4
   4. Body: Bronze
   5. End Connections: Union, solder joint
   6. Finish: Chrome plated or Rough bronze

B. Reduced-Pressure-Principle Backflow Preventers:
   1. Standard: ASSE 1013
   2. Operation: Continuous-pressure applications
   3. Pressure Loss: 12 psig maximum, through middle third of flow range
   4. Size: as per drawings
   5. Design Flow Rate: as per system requirement
   6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, steel with interior lining that complies with AWWA C550 or that is FDA approved 2-1/2 and larger.
   7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

8. Configuration: Designed for horizontal, straight-through, vertical-inlet, horizontal-center-section, and vertical-outlet or vertical flow.
9. Accessories:
    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Size: as per drawings.
5. Design Flow Rate: as per system requirements.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, steel with interior lining that complies with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight-through flow.
9. Accessories:
    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    a. Cash Acme; a division of Reliance Worldwide Corporation
    b. Conbraco Industries, Inc.
    c. Honeywell International Inc.
    d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company
    e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products

2. Standard: ASSE 1003
3. Pressure Rating: Initial working pressure of 150 psig
4. Size: as per drawings
5. Design Flow Rate: as per system requirements
6. Design Inlet Pressure: as per system requirements
7. Design Outlet Pressure Setting: as per system requirements
8. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
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.

2.6 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Conbraco Industries, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves
   c. Crane Co.; Crane Valve Group; Jenkins Valves
   d. Crane Co.; Crane Valve Group; Stockham Div.
   e. Hammond Valve
   f. Milwaukee Valve Company
   g. NIBCO Inc.
   h. Red-White Valve Corp.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller
5. Body: Copper alloy
6. Port: Standard or full port
7. Ball: Chrome-plated brass
8. Seats and Seals: Replaceable
9. End Connections: Solder joint or threaded
10. Handle: Vinyl-covered steel with memory-setting device.

2.7 TEMPERATURE-ACTUATED, ELECTRONIC WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    a. Armstrong International, Inc.
    b. Cash Acme; a division of Reliance Worldwide Corporation
    c. Conbraco Industries, Inc.
    d. Honeywell International Inc.
    e. Legend Valve
    f. Leonard Valve Company
    g. Powers; a division of Watts Water Technologies, Inc.
    h. Symmons Industries, Inc.
    i. TACO Incorporated
    j. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company
    k. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products
2. Standard: ASSE 1017
3. Pressure Rating: 125 psig
4. Type: Thermostatically controlled, water mixing valve
5. Material: Bronze body with corrosion-resistant interior components
6. Connections: Threaded union inlets and outlet
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: as per drawing
9. Tempered-Water Design Flow Rate: as per system requirement
10. Valve Finish: Chrome plated or Rough bronze

B. Primary, Thermostatic, Water Mixing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    a. Armstrong International, Inc.
    b. Lawler Manufacturing Company, Inc.
    c. Leonard Valve Company
    d. Powers; a division of Watts Water Technologies, Inc.
    e. Symmons Industries, Inc.
2. Standard: ASSE 1017
3. Pressure Rating: 125 psig minimum unless otherwise indicated.

4. Type: Exposed-mounted or Cabinet-type, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: as per drawing
9. Tempered-Water Design Flow Rate: as per system requirement
10. Valve Finish: Chrome plated, Polished, chrome plated or Rough bronze
11. Piping Finish: Chrome plated or Copper
12. Cabinet: Factory fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.

2.8 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 that complies with AWWA C550 or that is FDA approved, epoxy coated 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. Perforation Size:
    a. Strainers NPS 2 and Smaller: 0.020 inch to 0.033 inch
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch to 0.062 inch
    c. Strainers NPS 5 and Larger: 0.10 inch to 0.125 inch
6. Drain: Factory-installed, hose-end drain valve

2.9 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets
2. Body Material: Bronze
3. Seat: Bronze, replaceable
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7
6. Pressure Rating: 125 psig
7. Vacuum Breaker: Integral, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.

8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated
9. Finish for Service Areas: Chrome or nickel plated
10. Finish for Finished Rooms: Chrome or nickel plated
11. Operation for Equipment Rooms: Wheel handle or operating key
12. Operation for Service Areas: Wheel handle or Operating key
13. Operation for Finished Rooms: Operating key
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Standard: ASME A112.21.3M for concealed or exposed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze or Chrome plated.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze or Rough bronze.
11. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:
1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
4. Pressure Rating: 125 psig (860 kPa)
5. Operation: Loose key or wheel handle
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4
4. Body: Copper alloy
5. Ball: Chrome-plated brass
6. Seats and Seals: Replaceable
7. Handle: Vinyl-covered steel
8. Inlet: Threaded or solder joint
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.12 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. AMTROL, Inc.
   b. Josam Company
   c. MIFAB, Inc.
   d. Precision Plumbing Products, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products
   i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products
2. Standard: ASSE 1010 or PDI-WH 201
3. Type: Copper tube with piston
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.13 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. MIFAB, Inc.

b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Company, Inc.

d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company

2. Standard: ASSE 1018

3. Pressure Rating: 125 psig minimum

4. Body: Bronze

5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

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

a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.

3. Size: NPS 1-1/4 minimum

4. Material: Chrome-plated, cast brass

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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 unacceptable for this application.

3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.

F. Set non-freeze, non-draining-type post hydrants in concrete or pavement.

G. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

H. Install water-hammer arresters in water piping with shut-off valves and according to PDI-WH 201.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

J. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

3.4 DOMESTIC WATER PIPING SPECIALTIES WILL BE CONSIDERED DEFECTIVE IF THEY DO NOT PASS TESTS AND INSPECTIONS.

A. Prepare test and inspection reports.

3.5 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 221119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps
2. Horizontally mounted, in-line, close-coupled centrifugal pumps

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation
3. Federal Pump Corp.
4. Grundfos Pumps Corp.
5. Sico Pump
6. TACO Incorporated
7. WILO USA LLC - WILO Canada Inc.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, seal-less, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Bronze, with threaded or companion-flange connections.
3. Impeller: Plastic
4. Motor: Single speed, unless otherwise indicated.

D. Capacities and Characteristics (as specified on drawings)

1. Maximum Continuous Operating Temperature: 220 deg. F.

2.2 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alyan Pump Co.
2. Armstrong Pumps Inc.
3. Bell & Gossett Domestic Pump; ITT Corporation
4. Marshall Engineered Products Co.
5. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
6. Pentair Pump Group; Aurora Pump
7. TACO Incorporated
8. Thrush Company, Inc.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Pump Construction:

1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
5. Bearings: Oil-lubricated; bronze-journal or ball type.
6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

E. Capacities and Characteristics (as specified on drawings):

1. Minimum Working Pressure: 175 psig.
2. Maximum Continuous Operating Temperature: 225 deg. F.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg. F.
3. Enclosure: NEMA 250, Type 4X
4. Operation of Pump: On or off
5. Transformer: Provide if required
6. Power Requirement: 24 V, ac or 120 V, ac.
7. Settings: Start pump at 105 deg. F and stop pump at 125 deg. F.

B. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: NEMA 250, Type 1, suitable for wall mounting
3. Operation of Pump: On or off
4. Transformer: Provide if required
5. Power Requirement: 24-V ac or 120-V ac
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft horizontal.

D. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.

2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

E. Install thermostats in hot-water return piping.

F. Install timers on wall in engineer's office or in location decided by owner.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." 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.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

a. Horizontally mounted, in-line, close-coupled centrifugal pumps.

b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."

3. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

D. Connect thermostats and timers to pumps that they control.

3.3 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings
2. Specialty pipe fittings

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency. Only US made piping and accessories are acceptable.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class

B. Gaskets: ASTM C 564, rubber

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. ANACO-Husky
    b. MIFAB, Inc.
    c. Stant
    d. Tyler Pipe
2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky
   b. Clamp-All Corp.
   c. MIFAB, Inc.
   d. Stant
   e. Tyler Pipe
2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Dallas Specialty & Mfg. Co.
      2) Fernco Inc.
      3) Mission Rubber Company; a division of MCP Industries, Inc.
      4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
   b. Standard: ASTM C 1173.
   c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. Sleeve Materials:
      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Non-pressure Transition Couplings:

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

1) Cascade Waterworks Mfg. Co.

2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. 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.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger or as determined by local authority having jurisdiction or indicated in drawings.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

L. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod
2. NPS 3: 60 inches with 1/2-inch rod
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod
5. Spacing for 10-footlengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install supports for vertical copper tubing every 10 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 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.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor or in pit with pit cover flush with floor.

6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. 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 separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system

and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
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 required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

E. Aboveground, vent piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

G. Underground, soil and waste piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Backwater valves
   2. Cleanouts
   3. Floor drains
   4. Roof flashing assemblies
   5. Miscellaneous sanitary drainage piping specialties
   6. Flashing materials

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation
   2. Standard: ASME A112.14.1
   3. Size: Same as connected piping.
   4. Body: Cast iron
   5. Cover: Cast iron with bolted or threaded access check valve.

6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation
2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float
5. Inlet: Threaded
6. Outlet: Threaded or spigot

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass or cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company; Josam Div.
    b. Oatey.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Zurn Plumbing Products Group; Light Commercial Operation
    h. Zurn Plumbing Products Group; Specification Drainage Operation
2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing, threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing or Threaded, adjustable housing.
5. Body or Ferrule: Cast iron
6. Clamping Device: Required
7. Outlet Connection: Spigot or Threaded
8. Closure: Brass plug with straight threads and gasket, Brass plug with tapered threads or Cast-iron plug.
9. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, Painted cast iron, Polished bronze or Rough bronze.
11. Frame and Cover Shape: Round
12. Top Loading Classification: Heavy Duty or as specified
13. Riser: ASTM A 74, Extra-Heavy or Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation
2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head or drilled-and-threaded, brass or cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze or flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round or Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Commercial Enameling Co.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Prier Products, Inc.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Tyler Pipe; Wade Div.
   g. Watts Drainage Products Inc.
   h. Zurn Plumbing Products Group; Light Commercial Operation
   i. Zurn Plumbing Products Group; Specification Drainage Operation
2. Standard: ASME A112.6.3
3. Seepage Flange: where required for floor type/construction
4. Anchor Flange: where required for floor type/construction
5. Clamping Device: where required for floor type/construction
6. Outlet: Bottom or Side
7. Backwater Valve: Drain-outlet type
8. Coating in first subparagraph below is usually used only on sanitary floor drains.
9. Sediment Bucket: Required
10. Top or Strainer Material: Bronze, Gray iron or Nickel bronze
11. Top of Body and Strainer Finish: Nickel bronze, Polished bronze or Rough bronze
12. Top Shape: Round or Square

13. Top Loading Classification: Heavy Duty unless specified otherwise.
14. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection where required.
15. Trap Material: Bronze, Cast iron
16. Trap Pattern: Standard P-trap
17. Trap Features: Cleanout and trap-seal primer valve drain connection where required.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Acorn Engineering Company; Elmdor/Stoneman Div.
    b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap
2. Low-Silhouette Vent Cap: With vandal-proof vent cap
3. Extended Vent Cap: With field-installed, vandal-proof vent cap

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains :

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. 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 2-1/2 and Larger: 5-inch- minimum water seal

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS ½ side inlet.

D. 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.

E. 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.

F. 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.

G. 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.

2.6 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. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

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.

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. Set with grates depressed according to the following drainage area radii:
    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
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. Assemble open drain fittings and install with top of hub 2 inches above floor.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

M. Install vent caps on each vent pipe passing through roof.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 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.

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 Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 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 221319

SECTION 224100 - RESIDENTIAL PLUMBING FIXTURES

(Not all the products listed below will be required. Refer to specifications from Architect/Interior Designer as well)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bathtubs
2. Faucets
3. Bidets
4. Lavatories
5. Showers
6. Kitchen sinks
7. Laundry trays.
8. Dishwasher air-gap fittings
9. Disposers
10. Water closets
11. Toilet seats
12. Supply fittings
13. Waste fittings

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 BATHTUBS

A. Bathtubs: Enameled cast iron or Enameled steel or FRP or PMMA, with shower.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. Kohler Co.
    b. American Standard America
    c. Crane Plumbing, L.L.C.
    d. Eljer, Inc.
    e. Sterling; a Kohler company
    f. American Standard America
    g. Aqua Bath Company, Inc.
    h. Crane Plumbing, L.L.C.
2. Fixture:
    a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron or enameled-steel bathtubs.
    b. Standard: ANSI Z124.1.2 for FRP or PMMA bathtubs.
    c. Bathing Surface: Slip resistant according to ASTM F 462.
    d. Size: As specified or indicated on drawings.
    e. Color: White
    f. Drain Location: As specified or indicated on drawings.
    g. Drain: NPS 1-1/2; chrome-plated-brass, pop-up waste and overflow.
3. Faucet: Faucet designation from "Bathtub Faucets".
4. Supply Fittings: Included in faucet.
5. Tub Filler: Chrome-plated-brass diverter spout.
6. Waste Fittings:
    a. Standard: ASME A112.18.2/CSA B45.125.2.
    b. Drain: Stainless steel or chrome-plated brass, removable strainer.
    c. Overflow: Chrome-plated-brass escutcheon with toggle drain-plug device.
    d. Drain Piping: NPS 1-1/2 cast-brass overflow, P-trap, and waste.
    e. Drain Piping: NPS 1-1/2 P-trap and waste.

2.2 BATHTUB FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Bathtub Faucets: Single handle, pressure balance or thermostatic.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. American Standard America

b. Central Brass Company
c. Gerber Plumbing Fixtures LLC
d. Kohler Co.
e. Moen Incorporated
f. Powers; a division of Watts Water Technologies, Inc.
g. Speakman Company
h. Sterling; a Kohler company
i. Symmons Industries, Inc.
j. T & S Brass and Bronze Works, Inc.

2. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016
3. Faucet:
   a. Body Material: Solid brass
   b. Finish: Polished chrome plate
   c. Maximum Flow Rate: 2.5 gpm unless otherwise indicated
   d. Mounting: Concealed
   e. Operation: Single handle, push-pull or twist or rotate control, with hot- and cold-water indicators.
   f. Antiscald Device: Integral with mixing valve or Separate unit.
   g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
   h. Diverter: In-tub filler spout
   i. Supply Connections: NPS 1/2
4. Shower Head:
   a. Standard: ASME A112.18.1/CSA B125.1
   b. Type: As specified
   c. Backflow-Prevention Device: ASSE 1014
   d. Shower Head Material: Metallic with chrome-plated finish
   e. Spray Pattern: As specified
   f. Integral Volume Control: As specified
   g. Shower-Arm, Flow-Control Fitting: As specified
   h. Temperature Indicator: As specified
5. Bathtub Filler Spout: Chrome-plated brass

2.3 BIDETS

A. Bidets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. American Standard America
    b. Crane Plumbing, L.L.C.
    c. Eljer, Inc.
    d. Kohler Co.
    e. TOTO USA, INC.
2. Fixture:
    a. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china bidets.
    b. Type: As specified
    c. Hole Punching: Number and spacing to match faucet
    d. Mounting: Floor
    e. Overflow: As specified
    f. Color: White
3. Faucet:
    a. Standard: ASME A112.18.3.
    b. Type: Manufacturer's standard with vacuum breaker, diverter, and submerged spray, over-rim filling, pop-up drain, tailpiece, and chrome-plated finish.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article, except faucet includes pop-up drain.

2.4 LAVATORIES

A. Lavatories:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. Eljer, Inc.
    b. Kohler Co.
    c. American Standard America
    d. Crane Plumbing, L.L.C.
    e. Eljer, Inc.
    f. Elkay Manufacturing Co.
    g. TOTO USA, INC.
2. Fixture:
    a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron or -steel lavatories.

b. Standard: ANSI Z124.3 for PMMA lavatories.

c. Standard: ANSI Z124.3 and ANSI/ICPA SS-1 for solid-surface lavatories.

d. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel lavatories.

e. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china lavatories.

f. Type: As specified.

g. Oval Nominal Size: As specified or indicated on drawings.

h. Rectangular Nominal Size: As specified or indicated on drawings.

i. Round Nominal Size: As specified or indicated on drawings.

j. Faucet-Hole Punching: As per faucet used

k. Faucet-Hole Location: As per faucet used.

l. Color: White.

3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.

4. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.5 LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Single-control mixing, Single-control non-mixing, or two-handle mixing valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. BrassTech Inc.

b. Central Brass Company

c. Chicago Faucets

d. Delta Faucet Company

e. Eljer, Inc.

f. GROHE America, Inc.

g. Kohler Co.

h. Moen Incorporated

i. Price Pfister, Inc.

j. Watermark Designs, Ltd.

k. Delta Faucet Company

l. Moen Incorporated

m. Sterling; a Kohler company

2. Standard: ASME A112.18.1/CSA B125.1

3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
4. Body Material: General-duty, solid brass or General-duty, copper or brass underbody with brass cover plate.
5. Finish: Polished chrome plate or Polished brass
6. Maximum Flow Rate: 2.2 gpm (8.3 L/min.) or as otherwise specified.
7. Centers: As specified
8. Mounting: As specified
9. Valve Handle(s): As specified
10. Inlet(s): As required
11. Spout: Rigid unless Swing type specified
12. Spout Outlet: Aerator, Spray or Plain end
13. Operation: As specified
14. Drain: Pop up or Grid

2.6 SHOWERS

A. Showers : Standard FRP or PMMA with base and faucet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Aqua Glass Corporation
   b. Florestone Products Co., Inc.
   c. Sterling; a Kohler company
   d. Crane Plumbing, L.L.C.
   e. Kohler Co.
2. Standard: ANSI Z124.1.2
3. Nominal Size: As specified or indicated on drawings.
4. Surround: One piece or sealed, multiple piece.
5. Bathing Surface: Slip resistant according to ASTM F 462.
6. Color: White
7. Drain Location: As specified or indicated on drawings.

B. Showers: Accessible FRP or PMMA with seat, grab bar, base, and faucet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Aqua Glass Corporation
   b. Clarion Bathware
   c. Crane Plumbing, L.L.C.

2. Standards: ANSI Z124.1.2 and ICC/ANSI A117.1 for roll-in shower compartments.
3. Nominal Size: As specified or indicated on drawings.
4. Surround: One piece or sealed, multiple piece.
5. Bathing Surface: Slip resistant according to ASTM F 462.
6. Color: White
7. Drain Location: As specified or indicated on drawings.
8. Accessibility Options: Include grab bar and bench.
9. Drain: Grid, NPS 2

2.7 SHOWER FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Shower Faucets: As specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Standard America.
   b. Central Brass Company
   c. Kohler Co.
   d. Lawler Manufacturing Co., Inc.
   e. Moen Incorporated
   f. Powers; a division of Watts Water Technologies, Inc.
   g. Speakman Company
   h. Sterling; a Kohler company
2. Fixture:
   a. Standard: ASME A112.18.1/CSA B125.1 and ASSE 1016.
   b. General: Include hot- and cold-water indicators; check stops; and fixed shower head, arm, and flange, hand head complying with ASSE 1014 with arm, flange, hose, and bracket. Coordinate faucet inlets with supplies.
   c. Body Material: Solid brass
   d. Finish: Polished chrome plate or Polished brass
   e. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated
   f. Mounting: Concealed
   g. Backflow-Prevention Device for Hand-Held Shower: Required
   h. Operation: As specified
   i. Antiscald Device: Integral with mixing valve or Separate unit

j. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

3. Supply Connections: As specifed

4. Shower Head:

a. Type: As specified

b. Shower Head Material: With chrome-plated finish.

c. Spray Pattern: As specified

d. Integral Volume Control: Required

e. Shower-Arm, Flow-Control Fitting: 1.5 gpm (5.7 L/min.)

2.8 KITCHEN SINKS

A. Kitchen Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Kohler Co.

b. American Standard

c. Eljer, Inc.

d. Elkay Manufacturing Co.

e. Just Manufacturing.

f. Sterling; a Kohler company.

2. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron or -steel kitchen sinks.

b. Standard: ANSI Z124.3 for PMMA kitchen sinks

c. Standard: ANSI Z124.3 and ANSI/ICPA SS-1 for solid-surface kitchen sinks.

d. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.

e. Overall Dimensions: As specified or indicated on drawings.

f. Metal Thickness: 0.050 inch

g. Bowl:

1) Dimensions: As specified

2) Drain: 3-1/2-inch crumb cup or outlet for disposer.

3) Location: Centered in bowl or Near back of bowl or indicated on drawings.

3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.

4. Waste Fittings: Comply with requirements in "Waste Fittings" Article, except include continuous waste for multibowl sinks.

a. Disposer: where specified

b. Dishwasher Air-Gap Fitting: Comply with requirements in "Dishwasher Air-Gap Fittings" Article.

2.9 LAUNDRY TRAYS

A. Laundry Trays: Plastic.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Crane Plumbing, L.L.C.

b. Florestone Products Co., Inc.

c. Gerber Plumbing Fixtures LLC

2. Fixture:

a. Standard: IAPMO/ANSI Z124.6

b. Style: Flat-rim ledge

c. Material: Plastic, cast polymer, FRP, PMMA or PP.

d. Nominal Size: As specified or indicated on drawings.

e. Color: White

f. Mounting: Freestanding on manufacturer's standard legs or separate, painted-steel stand.

3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.

4. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.10 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets: As specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America

b. Bradley Corporation

c. BrassTech Inc.

d. Briggs Plumbing Products, Inc.

e. Central Brass Company

f. Chicago Faucets

g. Delta Faucet Company

h. Eljer, Inc.

i. Elkay Manufacturing Co.

j. GROHE America, Inc.

k. Kohler Co.

l. Moen Incorporated

m. Price Pfister, Inc.

n. Watermark Designs, Ltd.

2. Standard: ASME A112.18.1/CSA B125.1.

3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

4. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.

5. Finish: Polished chrome plate or Polished brass

6. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated

7. Mixing Valve: Single control or Two-lever handle

8. Backflow-Prevention Device for Hand Spray: Required

9. Centers: As specified

10. Mounting: As specified

11. Handle(s): As specified

12. Spout Type: As specified

13. Spout Outlet: As specified

14. Drain: Stopper with chain or Grid

2.11 DISHWASHER AIR-GAP FITTINGS

A. Dishwasher Air-Gap Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. B & K Industries, Inc.

b. Brass Craft Manufacturing; a subsidiary of Masco Corporation

c. BrassTech Inc.

d. Dearborn Brass

e. Geberit US

f. Sioux Chief Manufacturing Company, Inc.

g. Watts Brass & Tubular; a division of Watts Water Technologies, Inc.

2. Standard: ASSE 1021.

3. Description: Device designed to prevent backflow of contaminated liquid into domestic dishwashers.

4. Material: Plastic body with chrome-plated-brass cover.

5. Hose Connections: 5/8-inch-ID inlet and 7/8-inch-ID outlet.

6. Capacity: At least 5 gpm (0.32 L/s); at inlet pressure of at least 5 psig (35 kPa) and at temperature of at least 140 deg. F (60 deg. C).
7. Mounting: Deck
8. Hoses: Rubber and suitable for temperature of at least 140 deg. F (60 deg. C).
    a. Inlet Hose: 5/8 inch ID and 48 inches long
    b. Outlet Hose: 7/8 inch ID and 48 inches long

2.12 DISPOSERS

A. Disposers: Continuous-feed household, food waste.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. American Standard America
    b. Anaheim Manufacturing, Inc.; a Subsidiary of Western Industries, Inc.
    c. Franke Consumer Products, Inc.
    d. InSinkErator
    e. KitchenAid
    f. Maytag
2. Standards: ASSE 1008 and UL 430, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. General: Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
4. Model: Sound-insulated chamber and stainless-steel outer shell.
5. Motor: 115 V ac, 1725 rpm, with overload protection.

2.13 WATER CLOSETS

A. Water Closets: Floor mounted, floor outlet, close coupled (gravity tank), vitreous china.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. American Standard
    b. Crane Plumbing, L.L.C.
    c. Eljer, Inc.
    d. Kohler Co.
    e. TOTO USA, INC.
2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1, ASME A112.19.5, and ASSE 1037.

b. Bowl Type: Siphon jet

c. Height: Standard unless otherwise specified

d. Rim Contour: As specified

e. Water Consumption: Water saving

f. Color: White

3. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.

b. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.

c. Stop: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Loose key or Wheel handle

d. Riser:

1) Size: NPS 1/2

2) Material: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

B. Water Closets: Floor mounted, floor outlet, close coupled (flushometer tank), vitreous china.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard

b. Kohler Co.

c. Crane Plumbing, L.L.C.

d. Eljer, Inc.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.

b. Bowl Type: Siphon jet

c. Height: Standard unless otherwise specified.

d. Rim Contour: As specified

e. Water Consumption: Water saving

f. Color: White

3. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.

b. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.

c. Stop: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Loose key or Wheel handle

d. Riser:

1) Size: NPS 1/2

2) Material: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

2.14 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard

b. Church Seats

c. Eljer, Inc.

d. Kohler Co.

e. Olsonite Seat Co.

2. Standard: IAPMO/ANSI Z124.5

3. Material: Plastic

4. Type: Commercial (Standard)

5. Shape: As specified

6. Configuration: As specified with cover

7. Size: As specified or indicated on drawings

8. Hinge Type: Self-sustaining, check

9. Hinge Material: Noncorroding metal

10. Seat Cover: Required

11. Color: White

2.15 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Bidet, Lavatory, Kitchen Sink and Laundry Tray Supply Fittings:

1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.

2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.
    a. Operation: Loose key or Wheel handle.
3. Risers:
    a. Size: NPS 3/8 for bidets and lavatories.
    b. Size: NPS 1/2 for kitchen sinks and laundry trays.
    c. Material: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

2.16 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset tailpiece for accessible lavatories.

C. Drain: Pop-up type with NPS 1-1/4 straight tailpiece as part of faucet for standard lavatories.

D. Drain: Grid type with NPS 1-1/2 offset tailpiece for accessible kitchen sinks.

E. Drain: Grid type with NPS 1-1/2 straight tailpiece for standard kitchen sinks and laundry trays.

F. Trap:
1. Size: NPS 1-1/4 for bidets and lavatories
2. Size: NPS 1-1/2 for kitchen sinks and laundry trays
3. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall or two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall or one-piece, cast-brass trap with swivel 0.029-inch-thick tubular brass wall bend; and chrome-plated-brass or -steel wall flange.
4. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.17 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumbing fixtures level and plumb according to roughing-in drawings.

B. Install floor-mounted water closets on closet flange attachments to drainage piping.

C. Install counter-mounting fixtures in and attached to casework.

D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

E. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

F. Install toilet seats on water closets.

G. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

H. Install shower flow-control fittings with specified maximum flow rates in shower arms.

I. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

2. Exception: Omit trap on indirect wastes unless otherwise indicated.

J. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

K. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck or on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.

L. Set bathtubs and shower receptors in leveling bed of cement grout.

M. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

N. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

O. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.4 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224100

Essex County Farmworker Housing Renovation

MECHANICAL SPECIFICATIONS: BARN

1. GENERAL

A. THE "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION," AIA DOCUMENT A201, LATEST EDITION, AND THESE SPECIFICATIONS AS APPLICABLE ARE PART OF THIS CONTRACT.

B. CONTRACTOR SHALL BE NEW YORK STATE CLEAN HEAT CERTIFIED IN ORDER TO OBTAIN ENERGY CONSERVATION / ELECTRIFICATION REBATES FOR THE PROPOSED WORK.

C. ALL APPLICABLE CODES, LAWS AND REGULATIONS GOVERNING OR RELATING TO ANY PORTION OF THIS WORK ARE HEREBY INCORPORATED INTO AND MADE A PART OF THESE SPECIFICATIONS, AND THEIR PROVISIONS SHALL BE CARRIED OUT BY THE CONTRACTOR WHO SHALL INFORM THE OWNER, PRIOR TO SUBMITTING A PROPOSAL, OF ANY WORK OR MATERIALS WHICH VIOLATE ANY OF THE ABOVE LAWS AND REGULATIONS. ANY WORK DONE BY THE CONTRACTOR CAUSING SUCH VIOLATION SHALL BE CORRECTED BY THE CONTRACTOR.

D. INVESTIGATE EACH SPACE THROUGH WITCH EQUIPMENT MUST BE MOVED INCLUDING HALLWAYS, DOOR WIDTHS, ELEVATOR DIMENSIONS, ETC. WHERE NECESSARY, EQUIPMENT SHALL BE SHIPPED FROM MANUFACTURER IN SECTIONS OF SIZE SUITABLE FOR MOVING THROUGH AVAILABLE RESTRICTIVE SPACES. ASCERTAIN FROM BUILDING OWNER AT WHAT TIMES OF DAY EQUIPMENT MAY BE MOVED THROUGH ALL AREAS.

E. DUCTWORK AND PIPING IS SHOWN DIAGRAMMATICALLY AND DOES NOT SHOW ALL OFFSETS, DROPS AND RISES OF RUNS. THE CONTRACTOR SHALL ALLOW IN HIS PRICE FOR ROUTING OF DUCTWORK AND PIPING TO AVOID OBSTRUCTIONS. EXACT LOCATIONS ARE SUBJECT TO APPROVAL OF ARCHITECT. COORDINATION WITH THE EXISTING SERVICES, INCLUDING THOSE OF OTHER TRADES IS REQUIRED.

F. SUPPORT ALL DUCTWORK AND PIPING FROM BUILDING STRUCTURE AND/OR FRAMING IN AN APPROVED MANNER. WHERE OVERHEAD CONSTRUCTION DOES NOT PERMIT FASTENING OR SUPPORTS FOR EQUIPMENT, FURNISH ADDITIONAL FRAMING. INSERTS SHALL BE STEEL, SLOTTED TYPE AND FACTORY PAINTED. SINGLE ROD SHALL BE SIMILAR TO GRINNELL FIG. 281. MULTI-ROD SHALL BE SIMILAR TO FEE & MASON SERIES 9000 WITH END CAPS AND CLOSURE STRIPS. MAXIMUM LOADING INCLUDING PIPES, DUCTWORK CONTENTS AND COVERING SHALL NOT EXCEED 75% OF RATED INSERT CAPABILITY. WHEN SUPPORTING FROM BUILDING USE BEAM CLAMPS IN APPROVED MANNER.

G. INSTALL WORK SO AS TO BE READILY ACCESSIBLE FOR OPERATION, MAINTENANCE AND REPAIR. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ACCOMPLISH THIS, BUT CHANGES WHICH INVOLVE EXTRA COST SHALL NOT BE MADE WITHOUT APPROVAL.

H. REMOVAL AND RELOCATION OF CERTAIN EXISTING WORK WILL BE NECESSARY FOR THE PERFORMANCE OF THE GENERAL WORK. ALL EXISTING CONDITIONS CANNOT BE COMPLETELY DETAILED ON THE DRAWINGS. THE CONTRACTOR SHALL SURVEY THE SITE AND INCLUDE ALL CHANGES IN MAKING UP THE WORK PROPOSAL.

I. PLAN INSTALLATION OF NEW WORK AND CONNECTIONS TO EXISTING WORK TO ENSURE MINIMUM INTERFERENCE WITH REGULAR OPERATION OF EXISTING FACILITIES. ALL SYSTEM SHUTDOWNS AFFECTING OTHER AREAS SHALL BE COORDINATED WITH BUILDING OWNER. INSTALL ISOLATION VALVES AT POINT OF CONNECTION TO THE EXISTING PIPING. PROVIDE TEMPORARY DUCT CAPS AND/OR CONNECTIONS TO MINIMIZE SHUTDOWN TIME.

J. CONNECT NEW WORK TO EXISTING WORK IN NEAT AND APPROVED MANNER. RESTORE EXISTING WORK DISTURBED WHILE INSTALLING NEW WORK TO ACCEPTABLE CONDITION AS DETERMINED BY ARCHITECT.

K. DISCONNECT, REMOVE AND/OR RELOCATE EXISTING MATERIAL, EQUIPMENT AND OTHER WORK AS NOTED OR REQUIRED FOR PROPER INSTALLATION OF NEW SYSTEM.

L. THE CONTRACTOR SHALL KEEP ALL EQUIPMENT AND MATERIALS, AND ALL PARTS OF THE BUILDING, EXTERIOR SPACES AND ADJACENT STREETS, SIDEWALKS AND PAVEMENTS, FREE FROM MATERIAL AND DEBRIS RESULTING FROM THE EXECUTION OF THIS WORK. EXCESS MATERIALS WILL NOT BE PERMITTED TO ACCUMULATE EITHER ON THE INTERIOR OR THE EXTERIOR.

M. SEAL OPENINGS AROUND DUCTS AND PIPING THROUGH PARTITIONS, WALLS AND FLOORS (NOT IN SHAFTS) WITH MINERAL WOOL OR OTHER NONCOMBUSTIBLE MATERIAL.

N. PROVIDE ALL NECESSARY FLASHING AND COUNTERFLASHING TO MAINTAIN THE WATERPROOFING INTEGRITY OF THIS BUILDING AS REQUIRED BY THE INSTALLATION OR REMOVAL OF PIPES, DUCTS, LOUVERS, CONDUIT, AND EQUIPMENT. PROVIDE EQUIPMENT CURBS AND DUNNAGE STEEL AS REQUIRED.

O. ALL PRESENT MATERIAL, EQUIPMENT AND CONSTRUCTION DEBRIS TO BE REMOVED UNDER THIS CONTRACT, WITH THE EXCEPTION OF SPECIFIC EQUIPMENT AND APPARATUS REQUESTED BY THE BUILDING REPRESENTATIVE, ARCHITECT OR AS NOTED TO BE RELOCATED ON THE DRAWINGS, SHALL BE PROPERLY DISPOSED OF BY THIS CONTRACTOR.

P. MATERIALS AND WORKMANSHIP, UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

Q. THE WORK IN THE BUILDING SHALL BE DONE WHEN AND AS DIRECTED, AND IN A MANNER SATISFACTORY TO THE OWNER. THE WORK SHALL BE PERFORMED SO AS TO CAUSE THE LEAST POSSIBLE INCONVENIENCE AND DISTURBANCE TO THE PRESENT OCCUPANTS.

R. THE CONTRACTOR'S PROPOSAL FOR ALL WORK SHALL BE PREDICATED ON THE PERFORMANCE OF THE WORK DURING REGULAR WORKING HOURS. WHEN SO DIRECTED, HOWEVER, THE CONTRACTOR SHALL INSTALL WORK IN OVERTIME AND THE ADDITIONAL COST TO BE CHARGED THEREFORE SHALL BE ONLY THE PREMIUM PORTION OF THE WAGES PAID.

S. UNLESS OTHERWISE SPECIFIED, INCLUDE ALL CUTTING AND PATCHING OF EXISTING FLOORS, WALLS, PARTITIONS AND OTHER MATERIALS IN THE EXISTING BUILDING. THE CONTRACTOR SHALL RESTORE THESE AREAS TO ORIGINAL CONDITION.

T. ALL MATERIAL AND EQUIPMENT TO BE NEW UNLESS OTHERWISE NOTED AND SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

U. SUBMISSION OF A PROPOSAL SHALL BE CONSTRUED AS EVIDENCE THAT A CAREFUL EXAMINATION OF THE PORTIONS OF THE EXISTING BUILDING, EQUIPMENT, ETC. WHICH AFFECT THIS WORK, AND THE ACCESS TO SUCH SPACES, HAS BEEN MADE AND THAT THE CONTRACTOR IS FAMILIAR WITH EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT THE EXECUTION OF THE WORK. LATER CLAIMS SHALL NOT BE MADE FOR LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WHICH COULD HAVE BEEN FORESEEN DURING SUCH AN EXAMINATION. THE ON-SITE INSPECTION SHALL VERIFY EXISTING DUCTWORK, PIPING (SIZES, CLEARANCES, ETC.) AND CONDITIONS.

V. INSURANCE: IN ACCORDANCE WITH BUILDING REQUIREMENTS AND SHALL INCLUDE A HOLD HARMLESS CLAUSE FOR OWNER AND ENGINEER.

W. THE FINAL ACCEPTANCE WILL BE MADE AFTER THE CONTRACTOR HAS ADJUSTED HIS EQUIPMENT, BALANCED THE VARIOUS SYSTEMS, DEMONSTRATED THAT IT FULFILLS THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS AND HAS FURNISHED ALL THE REQUIRED CERTIFICATES OF INSPECTION AND APPROVAL.

X. GUARANTEE:

i. ALL MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THIS WORK. FINAL ACCEPTANCE SHALL BE DEFINED AS THE TIME AT WHICH THE MECHANICAL WORK IS TAKEN OVER AND ACCEPTED BY THE OWNER, AND IS UNDER CARE, CUSTODY, AND CONTROL OF THE OWNER. ENGAGE THE SERVICES OF VARIOUS MANUFACTURERS SUPPLYING THE EQUIPMENT FOR THE PROPER STARTUP AND OPERATION OF ALL SYSTEMS INSTALLED. INSTRUCT THE OWNERS PERSONNEL IN THE PROPER OPERATION AND SERVICING OF THE SYSTEM.

ii. THE CONTRACTOR SHALL GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY W0RKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN THE GUARANTEE PERIOD. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL INCLUDE RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS,

REPAIRS OR REPLACEMENTS IN EQUIPMENT SUPPLIED BY THIS CONTRACTOR.

iii. THIS CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE AND OPERATION OF ALL SYSTEMS UNTIL THE FINAL ACCEPTANCE OF THE WORK.

iv. ALL AIR CONDITIONING UNIT COMPRESSORS AND REFRIGERATION COMPONENTS SHALL HAVE A 5-YEAR WARRANTY.

Y. SPECIFICATIONS ARE OF SIMPLIFIED FORM AND INCLUDE INCOMPLETE SENTENCES. WORDS OR PHRASES SUCH AS "THE CONTRACTOR SHALL," "SHALL BE," "FURNISH," "PROVIDE," "A," "THE," AND "ALL" HAVE BEEN OMITTED FOR BREVITY.

Z. DEFINITIONS:

i. "PROVIDE": TO SUPPLY, INSTALL AND CONNECT UP COMPLETE AND READY FOR SAFE AND REGULAR OPERATION THE PARTICULAR WORK REFERRED TO UNLESS SPECIFICALLY OTHERWISE NOTED.

ii. "INSTALL": TO ERECT, MOUNT AND CONNECT COMPLETE WITH RELATED ACCESSORIES.

iii. "FURNISH" OR "SUPPLY": TO PURCHASE, PROCURE, ACQUIRE AND DELIVER COMPLETE WITH RELATED ACCESSORIES.

iv. "WORK": LABOR, MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES AND OTHER ITEMS REQUIRED FOR PROPER AND COMPLETE INSTALLATION.

v. "CONCEALED": EMBEDDED IN MASONRY OR OTHER CONSTRUCTION, INSTALLED IN FURRED SPACES, WITHIN DOUBLE PARTITIONS OR HUNG CEILINGS, IN TRENCHES, IN CRAWL SPACES, OR IN ENCLOSURES.

vi. "EXPOSED": NOT INSTALLED UNDERGROUND OR "CONCEALED" AS DEFINED ABOVE.

vii. "SIMILAR" OR "EQUAL": EQUAL IN MATERIALS, WEIGHT, SIZE, DESIGN AND EFFICIENCY OF SPECIFIED PRODUCT.

2. SCOPE OF WORK

A. THE WORK UNDER CONTRACT INCLUDES ALL LABOR, MATERIALS AND APPLIANCES NECESSARY FOR THE FURNISHING, INSTALLING AND TESTING, COMPLETE AND READY FOR SAFE OPERATION OF THE SYSTEMS. WORK SHALL BE INSTALLED IN A NEAT, WORKMANLIKE MANNER.

B. THE CONTRACTOR SHALL GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH THE DEPARTMENT HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT THIS WORK AND PAY ALL FEES THEREFORE. THE

CONTRACTOR SHALL ARRANGE FOR INSPECTION AND TESTS OF ANY OR ALL PARTS OF THE WORK IF SO REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. THE CONTRACTOR SHALL PAY ALL COSTS FOR, AND FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO THIS WORK.

C. THE CONTRACTOR SHALL FURNISH A WRITTEN GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY WORKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN ONE YEAR FROM THE DATE OF FINAL CERTIFICATE FOR PAYMENT AND/OR FROM DATE OR ACTUAL USE OF EQUIPMENT OR OCCUPANCY OF SPACES, BY OWNER, INCLUDED UNDER THE VARIOUS PARTS OF THE WORK, WHICHEVER DATE IS EARLIER. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL ALSO PROVIDE THAT WHERE DEFECTS OCCUR, THE CONTRACTOR WILL ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS, REPAIRS OR REPLACEMENTS IN EQUIPMENT SUPPLIED BY THE CONTRACTOR.

D. PERMITS AND FEES

i. THE CONTRACTOR SHALL GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH THE DEPARTMENT HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT THIS WORK AND PAY ALL FEES THEREFORE. THE CONTRACTOR SHALL ARRANGE FOR INSPECTION AND TEST OF ANY OR ALL PARTS OF THE WORK IF SO REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. THE CONTRACTOR SHALL PAY ALL COSTS FOR, FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO THIS WORK.

ii. THIS CONTRACTOR SHALL PREPARE OR HIRE THE NECESSARY CONSULTANTS TO PREPARE AND FILE ALL PLANS, CALCULATION, FORMS, ETC. REQUIRED FOR FILING WITH ALL AGENCIES REQUIRED FOR THIS WORK INCLUDING BUT NOT LIMITED TO THE DEP (DEPARTMENT OF ENVIRONMENTAL PROTECTION), DEC (DEPARTMENT OF ENVIRONMENTAL CONSERVATION), BUREAU OF AIR RESOURCES, EPA (ENVIRONMENTAL PROTECTION AGENCY), FDNY, ETC.

E. INSPECTIONS & TESTING / SPECIAL INSPECTIONS

i. THIRD PARTY INSPECTION AGENCY SHALL BE HIRED BY THE OWNER TO PERFORM ALL INSPECTIONS REQUIRED BY ALL LOCAL CODES.

F. PRIOR TO THE INSTALLATION OF ANY WORK AND PROCUREMENT OF EQUIPMENT PROVIDE COMPLETE SET OF COORDINATED SHOP DRAWINGS OF ALL NEW AND EXISTING EQUIPMENT, DUCTWORK, PIPING AND CONTROL SYSTEMS INDICATING CAPACITY DIMENSIONS AND SEQUENCE OF OPERATION FOR WRITTEN APPROVAL BY THE ARCHITECT AND ENGINEER.

G. WITHIN 15 DAYS AFTER AWARD OF CONTRACT, SUBMIT FOR REVIEW, A LIST OF ALL MATERIAL AND EQUIPMENT MANUFACTURER'S PRODUCTS THAT ARE PROPOSED, AS WELL AS NAMES OF ALL SUBCONTRACTORS WHOM THIS TRADE PROPOSES TO UTILIZE ON THIS PROJECT.

3. SHOP DRAWINGS

A. INDICATE ON EACH SUBMISSION: PROJECT NAME AND LOCATION, ARCHITECT AND ENGINEER, ITEM IDENTIFICATION AND APPROVAL STAMP OF PRIME CONTRACTOR, SUBCONTRACTOR NAMES AND PHONE NUMBERS, REFERENCE TO THE APPLICABLE DESIGN DRAWING OR SPECIFICATION ARTICLE, DATE AND SCALE.

B. THE WORK DESCRIBED IN ALL SHOP DRAWING SUBMISSION SHALL BE CAREFULLY CHECKED FOR ALL CLEARANCES (INCLUDING THOSE REQUIRED FOR MAINTENANCE AND SERVICING), FIELD CONDITIONS, MAINTENANCE OF ARCHITECTURAL CONDITIONS AND PROPER COORDINATION WITH ALL TRADES ON THE JOB.

C. EACH SUBMITTED SHOP DRAWING IS TO INCLUDE A CERTIFICATION THAT ALL RELATED JOB CONDITIONS HAVE BEEN CHECKED AND VERIFIED AND THAT THERE ARE NO CONFLICTS.

D. ALL SHOP DRAWINGS ARE TO BE SUBMITTED TO ALLOW 5 BUSINESS DAYS FOR CHECKING IN ADVANCE OF FIELD REQUIREMENTS. ALL SUBMITTALS TO BE COMPLETE AND CONTAIN ALL REQUIRED AND DETAILED INFORMATION. SHOP DRAWINGS WITH MULTIPLE PARTS SHALL BE SUBMITTED AS A PACKAGE.

E. IF SUBMITTALS DIFFER FROM THE CONTRACT DOCUMENT REQUIREMENTS, MAKE SPECIFIC MENTION OF SUCH DIFFERENCES IN A LETTER OF TRANSMITTAL, WITH REQUEST FOR SUBSTITUTION, TOGETHER WITH REASONS FOR SAME.

F. ELECTRONIC COPIES OF ENGINEERING DRAWINGS:

i. IF THE CONTRACTOR REQUIRES (.DWG) FORMAT. THE DRAWINGS WILL BE FORWARDED ONLY UPON RECEIPT OF SIGNED ACCEPTANCE OF TERMS FORM. PERMISSION FROM THE ARCHITECT MUST FIRST BE OBTAINED FOR ENGINEER TO INCLUDE THE ARCHITECTURAL BACKGROUND AS REFERENCE. THE CONTRACTOR IS TO OBTAIN THE ARCHITECT'S LATEST DRAWINGS DIRECTLY FROM THE ARCHITECT.

ii. THESE FILES ARE BEING ISSUED FOR THE CONVENIENCE OF THE CONTRACTOR AND THE CONTRACTOR REMAINS RESPONSIBLE FOR ALL CONTRACT REQUIREMENTS RELATED TO THE NORMAL SHOP DRAWING PREPARATION PROCESS.

G. SUBMISSIONS:

i. PROVIDE ALL COORDINATION DRAWINGS, DUCTWORK AND PIPING SHOP DRAWINGS IN PDF FORMAT – PAPER SUBMISSIONS SHALL NOT BE ACCEPTED.

THE ARCHITECT WILL FORWARD ALL SUBMISSIONS TO THE ENGINEER.

H. SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:

i. SHEET METAL SHOP DRAWING (3/8 INCH SCALE)

ii. SHEET METAL & PIPING SHOP STANDARDS

SHEETMETAL SHOP STANDARDS SHALL BE COMPILED DIRECTLY FROM THE “SMACNA DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE” MANUAL. MODIFICATIONS FOR A SPECIFIC PROJECT, IF ANY, SHALL BE INDICATED DIRECTLY ON THE SMACNA TEMPLATES. MODIFIED SHOP STANDARDS NOT TAKEN DIRECTLY FROM THE SMACNA TEMPLATES WILL NOT BE ACCEPTED. ANY DEVIATIONS FROM SMACNA SHALL BE NOTED.

iii. AIR OUTLETS

iv. AIR AND WATER BALANCE REPORT

v. AC UNITS

vi. FANS & ERVs

vii. VFD DRIVES

viii. TERMINAL BOXES (VAV, FAN POWERED, ETC.)

ix. PUMPS

x. VALVES

xi. PIPING LAYOUT: DETAIL, AT 3/8 INCH SCALE PIPING LAYOUT WITH FITTINGS, VALVES AND EQUIPMENT, USE SINGLE LINE FOR PIPE SIZES 3 INCHES AND SMALLER, AND DOUBLE LINE FOR PIPE SIZES 4 INCHES AND GREATER. FABRICATION OF PIPE ANCHORS, HANGERS, SUPPORTS FOR MULTIPLE PIPES, ALIGNMENT GUIDES, EXPANSION JOINTS AND LOOPS, AND ATTACHMENTS OF THE SAME TO THE BUILDING STRUCTURE. DETAIL LOCATION OF ANCHORS, ALIGNMENT GUIDES, AND EXPANSION JOINTS AND LOOPS SUBMIT ALL WELDING CERTIFICATES.

xii. BOILERS

xiii. VIBRATION AND SEISMIC ISOLATION

xiv. DAMPER AND VALVE ACTUATORS

xv. AUTOMATIC CONTROL SYSTEMS AND DEVICES

xvi. SEQUENCE OF OPERATIONS

I. COORDINATION DRAWINGS: CONTRACTOR SHALL PROVIDE PLANS AT 3/8 INCH SCALE INDICATING COORDINATION BETWEEN THE TRADES USING INPUT FROM INSTALLERS OF THE ITEMS INVOLVED.

i. DUCT AND PIPING INSTALLATION INDICATING COORDINATION WITH GENERAL CONSTRUCTION, BUILDING COMPONENTS, AND OTHER BUILDING SERVICES. INDICATE LOCATIONS AND SIZES OF ALL OPENINGS IN FLOOR, WALLS AND ROOF THAT MAY BE REQUIRED.

ii. COORDINATION WITH SUSPENDED CEILING COMPONENTS, STRUCTURAL MEMBERS TO WHICH DUCT WILL BE ATTACHED, SIZE AND LOCATION OF INITIAL ACCESS MODULES FOR ACOUSTICAL TILE, PENETRATIONS OF SMOKE BARRIERS AND FIRE-RATED CONSTRUCTION, LIGHTING FIXTURES, AIR OUTLETS AND INLETS, SPEAKERS, SPRINKLERS, ACCESS PANELS, PERIMETER MOLDINGS SHALL BE PERFORMED.

4. AS-BUILTS AND EQUIPMENT OPERATION INSTRUCTIONS

A. PROVIDE ALL COORDINATION DRAWINGS, DUCTWORK AND PIPING AS-BUILTS IN AUTOCAD 2013 AND PDF FORMAT. ALL CATALOG CUTS AND SUBMITTALS TO BE PROVIDED IN ELECTRONIC PDF FORMAT. THE ARCHITECT WILL FORWARD ALL SUBMISSIONS TO THE ENGINEER.

B. ON COMPLETION AND ACCEPTANCE OF WORK, THIS CONTRACTOR SHALL FURNISH WRITTEN INSTRUCTIONS, EQUIPMENT MANUALS AND DEMONSTRATE TO THE OWNER THE PROPER OPERATION AND MAINTENANCE OF ALL EQUIPMENT AND APPARATUS FURNISHED UNDER THIS CONTRACT.

C. THESE INSTRUCTIONS SHALL BE TYPED ON 8-1/2 INCH X 11 IN FORMAT. THE CONTRACTOR SHALL GIVE ONE COPY OF THE INSTRUCTIONS TO THE OWNER AND ONE COPY TO THE ENGINEER.

D. THE INSTRUCTIONS SHALL BE ORGANIZED IN SECTIONS, WITH ONE SECTION PER SYSTEM. THE COVER OF THE INSTRUCTION BOOKLET SHALL BEAR THE NAME, ADDRESS AND PHONE NUMBER OF THE PROJECT, ARCHITECT, ENGINEER, MECHANICAL CONTRACTOR AND SUBCONTRACTORS.

E. FINAL AS-BUILT DRAWINGS INDICATING AS INSTALLED CONDITIONS SHALL BE PROVIDED TO THE ARCHITECT AND ENGINEER AFTER COMPLETION OF THE INSTALLATION.

5. SUBSTITUTIONS

A. NO SUBSTITUTE MATERIAL OR MANUFACTURER OF EQUIPMENT SHALL BE PERMITTED WITHOUT A FORMAL WRITTEN SUBMITTAL TO THE ENGINEER WHICH INCLUDES ALL

DIMENSIONAL, PERFORMANCE AND MATERIAL SPECIFICATIONS. ANY CHANGES IN LAYOUT, ELECTRICAL CHARACTERISTICS, STRUCTURAL REQUIREMENTS OR DESIGN DUE TO THE USE OF A SUBSTITUTION SHALL BE SUBMITTED TO THE ENGINEER AS PART OF THIS PROPOSAL. THE CONTRACTOR TAKES FULL RESPONSIBILITY FOR THE SUBSTITUTION AND ALL CHANGES RESULTING FROM THE SUBSTITUTION. ALL ITEMS SHALL BE SUBMITTED FOR REVIEW IN CONJUNCTION WITH THE SUBMITTAL OF THE SUBSTITUTION. ANY SUBSTITUTION MUST BE SUBMITTED WITH AN EXPLANATION WHY A SUBSTITUTION IS BEING UTILIZED. IF THE SUBSTITUTED ITEM DEVIATES FROM THE SPECIFIED ITEM, THOSE DEVIATIONS ARE TO BE IDENTIFIED ON A LINE BY LINE BASIS. IF THE SUBSTITUTE IS BEING UTILIZED FOR FINANCIAL REASONS, THE ASSOCIATED CREDIT MUST BE SIMULTANEOUSLY SUBMITTED.

B. ALL SUBSTITUTED EQUIPMENT SHALL CONFORM TO SPACE REQUIREMENTS AND PERFORMANCE REQUIREMENTS SHOWN ON CONTRACT DOCUMENTS. CONTRACTOR SHALL REPLACE ANY EQUIPMENT THAT DOES NOT MEET THESE REQUIREMENTS AT HIS OWN EXPENSE. ANY MODIFICATIONS TO ASSOCIATED SYSTEMS OR ADDITIONAL COSTS ATTRIBUTED TO THIS SUBSTITUTION SHALL BE AT THIS CONTRACTOR'S EXPENSE.

C. CONTRACTOR SHALL SUBMIT BID BASED ON SPECIFIED ITEMS AND SHALL SUPPLY AS AN ALTERNATE PRICE ANY SUBSTITUTIONS.

6. SERVICE AND WARRANTY (MAINTENANCE CONTRACT)

A. THIS CONTRACTOR SHALL PROVIDE AS AN ADD ALTERNATE PRICE, A FULL ONE YEAR SERVICE OF ALL MECHANICAL COMPONENTS AND SYSTEMS, WITH PRICES FOR YEARS 2, 3 AND 4 FOLLOWING THIS FIRST YEAR. AT THE TIME OF ACCEPTANCE OF PROJECT, THE TENANT OR OWNER'S REPRESENTATIVE WILL DECIDE TO ACCEPT WHICH ALTERNATE, IF ANY. THIS IS IN ADDITION TO THE WARRANTY BEING PROVIDED AS PART OF THE BASE CONTRACT.

7. ACCESS DOORS IN GENERAL CONSTRUCTION

A. THIS CONTRACTOR SHALL SUBMIT TO THE ARCHITECT FOR APPROVAL A PLAN INDICATING THE SIZE (MINIMUM 18 INCH X 18 INCH) AND LOCATION OF ALL ACCESS DOORS REQUIRED FOR OPERATION AND MAINTENANCE OF ALL CONCEALED EQUIPMENT, DEVICES, VALVES, DAMPERS AND CONTROLS. CONTRACTOR SHALL ARRANGE FOR FURNISHING AND INSTALLATION OF ALL ACCESS DOORS IN FINISHED CONSTRUCTION AND INCLUDE COSTS IN THE BID.

B. REMOVABLE ACCESS TILE AND/OR ACCESS DOOR ARE REQUIRED IN HUNG CEILINGS, SHAFTS AND WALLS FOR ALL EQUIPMENT, DAMPERS, VALVES, ETC. HVAC CONTRACTOR TO FURNISH ACCESS LOCATION REQUIREMENTS TO GENERAL CONTRACTOR. ACCESS TILE IDENTIFICATION: PROVIDE BUTTONS, TABS, AND MARKERS TO IDENTIFY LOCATION OF CONCEALED VALVES, DAMPERS AND EQUIPMENT.

8. SHEET METAL WORK

A. DUCT CONSTRUCTION, INCLUDING SHEET METAL THICKNESSES, SEAM AND JOINT

CONSTRUCTION, REINFORCEMENTS, HANGERS AND SUPPORTS, SHALL COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" LATEST EDITION AND PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA INDICATED.

B. EXCEPT AS OTHERWISE SHOWN OR NOTED, ALL DUCTWORK AND OTHER SHEET METAL WORK SHALL BE GALVANIZED SHEET STEEL

C. DESCRIPTION OF DUCTWORK PRESSURE CLASS AND EQUIPMENT:

i. 2 INCH DUCT CLASS AND LESS: ALL OTHER LOW PRESSURE DUCTOWORK. SEAL CLASS C, LEAKAGE CLASS 24 (RECTANGULAR) OR CLASS 12 (ROUND).

ii. 3 INCH DUCT CLASS: ALL SUCTION AND DISCHARGE OF KITCHEN EXHAUST AND OTHER EXHAUST DUCTWORK. SEAL CLASS B, LEAKAGE CLASS 12 RECTANGULAR METAL OR CLASS 6 (ROUND).

iii. 4 INCH AND GREATER DUCT CLASS: ALL SUPPLY/RETURN DUCTWORK FROM DISCHARGE/INTAKE OF FANS, AIR HANDLING UNITS OR AC UNITS TO INLET/OUTLET OF TERMINAL BOXES ON FLOOR, ALL OUTDOOR DUCTWORK AND ALL DUCTWORK RUNNING THROUGH UNCONDITIONED SPACES. SEAL CLASS A, LEAKAGE CLASS 6 (RECTANGULAR METAL) OR CLASS 3 (ROUND).

D. GENERAL FABRICATION REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", LATEST EDITION, BASED ON INDICATED STATIC-PRESSURE CLASS UNLESS OTHERWISE INDICATED.

i. THE FOLLOWING FITTING CONNECTIONS AND DUCT CONSTRUCTION GAUGES ARE NOT ACCEPTABLE

a) DRIVE SLIP [T-1, T-2] FITTING CONNECTIONS

b) 26 GAUGE DUCTWORK.

ii. TRANSVERSE JOINTS: SELECT JOINT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", "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." FITTINGS AND/OR JOINTS OF TWO DIFFERENT GAUGES, CONNECTED JOINT RATING SHALL MEET MORE STRINGENT CONDITIONS.

iii. USE THE FOLLOWING SMACNA TRANSVERSE (GIRTH) JOINTS

a) DUCT CONSTRUCTION AS FOLLOWS FOR 2 INCH W.G. CLASS:
(1) UP TO 12 INCH WIDE USE T-6 OR T-7
(2) 13 INCH TO 28 INCH WIDE USE T-11 OR T12
(3) 29 INCH WIDE AND UP USE TDC OR TDF

b) DUCT CONSTRUCTION AS FOLLOWS FOR 3 INCH W.G. CLASS:
(1) UP TO 20 INCH WIDE USE T-6 OR T-7
(2) 21 INCH TO 24 INCH WIDE USE T-11 OR T12
(3) 25 INCH WIDE AND UP USE TDC OR TDF

c) DUCT CONSTRUCTION AS FOLLOWS FOR 4 INCH W.G. CLASS:
(1) UP TO 12 INCH WIDE USE T-6 OR T-7
(2) 13 INCH TO 18 INCH WIDE USE T-11 OR T12
(3) 19 INCH WIDE AND UP USE TDC OR TDF

E. VOLUME DAMPERS: GALVANIZED STEEL, PER SMACNA "LOW VELOCITY MANUAL," EXCEPT PROVIDE BEARING AT ONE END OF DAMPER ROD AND QUADRANT, WITH LEVER AND LOCKSCREW AT OTHER END. FOR INSULATED DUCTS, QUADRANTS MOUNTED ON COLLAR TO CLEAR INSULATION. INSTALL WITH LEVERS ACCESSIBLE.

i. PROVIDE MANUAL BALANCING VOLUME DAMPERS AS REQUIRED TO PROPERLY BALANCE THE AIR DISTRIBUTION SYSTEM. IF THE LOCATION OF BALANCING DAMPERS ARE NOT DEFINED ON THE DRAWINGS, THE FOLLOWING MINIMUM STANDARDS SHALL GOVERN:

a) LOW PRESSURE: ALL SUPPLY AIR MAIN BRANCHES FROM TRUNK, EACH SPLIT, AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.

b) LOW PRESSURE: ALL EXHAUST AND RETURN BRANCHES FROM TRUNK, EACH SPLIT AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.

F. FLEXIBLE DUCTWORK SHALL NOT BE USED ON THIS PROJECT.

G. ACCESS DOORS: INSULATED OR UNINSULATED, SAME AS DUCT.

i. PROVIDE MINIMUM 20 INCH X 14 INCH ON MAIN DUCTS, AND 12 INCH X 6 INCH ON BRANCH DUCTS, UNLESS OTHERWISE APPROVED, AT FIRE DAMPERS, AND AT ALL DUCT ACCESSORIES SUCH AS HUMIDIFIERS, DUCT SMOKE DETECTORS, AUTO DAMPERS, AND LOUVERS.

ii. ALL ACCESS DOORS TO BE HINGED, WITH LATCH SIMILAR TO VENTLOCK NO. 100.

H. FLEXIBLE CONNECTIONS: NEOPRENE-COATED GLASS FABRIC, 30 OZ PER SQUARE YD WITH SEWED AND CEMENTED SEAMS, SIMILAR TO VENT FABRICS. PROVIDE WITH METAL COLLARS. ALLOW MINIMUM MOVEMENT OF 1 INCH.

I. TURNING VANES: GALVANIZED STEEL SMALL DOUBLE-THICKNESS VANES WITH 2 INCH INSIDE RADIUS.

J. FIRE DAMPERS: DYNAMIC; RATED AND LABELED ACCORDING TO UL 555 BY AN NRTL GALVANIZED STEEL CONSTRUCTION, CURTAIN TYPE WITH BLADES OUT OF THE AIRSTREAM (TYPE B), SPRING LOADED, EQUIPPED WITH FUSIBLE LINK, CONFORMING TO NFPA STANDARD 90A AND APPROVED BY NEW YORK CITY, SIMILAR TO POTOROFF OR RUSKIN, RATED AS REQUIRED. PROVIDE FIRE DAMPERS AS NOTED ON THE PLANS AND IN DUCTS AND OPENINGS IN SHAFTS, FLOORS, FIRE WALLS, FIRE-RESISTANCE PARTITIONS, FIRE RATED CEILINGS, EXIT CORRIDOR WALLS. PROVIDE ACCESS DOOR IN DUCT ADJACENT TO EACH FIRE DAMPER. SEE INSTALLATION ON DRAWING.

K. COMBINATION FIRE/SMOKE DAMPERS:

i. COMBINATION FIRE/SMOKE DAMPERS SHALL BE INSTALLED AS INDICATED ON DRAWING AND AS REQUIRED BY LOCAL CODES. DAMPERS TO BE UL 555S LATEST EDITION LISTED AND LABELED AND IN CONFORMANCE WITH NFPA.

ii. COMBINATION FIRE/SMOKE DAMPERS SHALL BE CLASS 1 (ONE), DUAL OVERRIDE REMOTE RESETTABLE, OPPOSED MULTIBLADE TYPE WITH FIRESTAT OR EQUIVALENT HEAT RESPONSIVE DEVICE, 120-VOLT ACTUATOR AS REQUIRED MOUNTED OUT OF THE AIR STREAM, WITH DAMPER OPERATOR AND BLADE POSITION INDICATOR SWITCHES. PROVIDE MOTOR MOUNT BRACKET STRENGTHENER FOR DAMPERS OVER 10 INCH IN HEIGHT. PROVIDE A 10 GAUGE WELDED VERTICAL STIFFENER AT EACH CORNER TO PREVENT DAMPER MISALIGNMENT.

iii. PROVIDE ACCESS DOOR IN DUCT ADJACENT TO EACH FIRE/SMOKE DAMPER.

iv. PROVIDE FIRE/SMOKE DAMPERS AS NOTED ON THE PLANS AND IN DUCTS AND OPENINGS IN SHAFTS, FLOORS, FIRE WALLS, FIRE-RESISTANCE PARTITIONS, FIRE RATED CEILINGS AND SMOKE BARRIERS.

v. THE HVAC CONTRACTOR SHALL PROVIDE ALL DEVICES, RELAYS, END SWITCHES, E/P SWITCHES, CONTROL COMPONENTS, AIR PIPING, POWER WIRING, CONTROL WIRING AND INTERLOCK WIRING AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF OPERATION FOR THESE DAMPERS.

vi. DAMPERS SHALL BE MANUFACTURED BY GREENHECK MODEL FSD-311, RUSKIN MODEL FSD-60, OR APPROVED EQUAL.

vii. MODULATING COMBINATION FIRE/SMOKE DAMPERS TO BE PROVIDED WITH ACTUATORS RATED AND TESTED FOR THIS APPLICATION.

viii. SEE INSTALLATION ON DRAWING.

L. ALL DUCT DIMENSIONS INDICATED ON PLANS ARE INSIDE CLEAR DIMENSIONS. INCREASE DUCT DIMENSIONS AS REQUIRED TO ACCOUNT FOR INTERNAL LINING.

M. AUTOMATIC DAMPERS: COMPLETE WITH LINKAGE AND ELECTRIC OPERATOR. OPPOSED BLADE DAMPER OR GALVANIZED STEEL MIN. 4 INCH, MAX. 8 INCH WIDE WITH

COMPRESSIBLE EDGE SEALS TO PREVENT LEAKAGE. FACTORY-ASSEMBLE STEEL LINKAGE AND SHAFT WITH NYLON OR OIL-IMPREGNATED BRONZE BEARINGS. MOTOR WITH SUFFICIENT POWER TO LIMIT LEAKAGE TO 10 CFM PER SQUARE FEET. LINKAGE TO WITHSTAND LOAD EQUAL TO TWICE MAXIMUM OPERATING FORCE WITHOUT DEFLECTION. DAMPER MOUNTED IN WELDED STEEL CHANNEL FRAME.

i. SHUTOFF DAMPERS SHALL BE CLASS I MOTORIZED DAMPERS WITH AN AIR LEAKAGE RATE NOT GREATER THAN 4 CFM/SF OF DAMPER SURFACE AREA AT 1.0 INCH WG AND AMCA 500D LISTED.

N. EXTERIOR LOUVERS: 4 INCH WIDE STATIONARY LOUVER, EXTRUDED ALUMINUM, 0.081 INCH WALL THICKNESS, 6063T5 ALLOY BLADES AND FRAME WITH STAINLESS STEEL OR ALUMINUM FASTENERS. LOUVER TO INCORPORATE STRUCTURAL SUPPORT TO WITHSTAND WIND LOAD OF 20 LBS PER SQUARE FEET. PROVIDE REMOVABLE 3/4 INCH X 3/4 INCH ALUMINUM BIRDSCREEN IN AN ALUMINUM FRAME. AIR PERFORMANCE AND WATER PENETRATION LESS THAN OR EQUAL TO GREENHECK. COORDINATE ALL REQUIREMENTS WITH THE BUILDING MANAGEMENT AND ARCHITECT. LOUVER TO COMPLY WITH BASE BUILDING STANDARDS.

O. ALUMINUM DUCTWORK:

i. ALUMINUM SHEETS: COMPLY WITH ASTM B 209ALLOY 3003, H14 TEMPER; WITH MILL FINISH FOR CONCEALED DUCTS, AND STANDARD, ONE-SIDE BRIGHT FINISH FOR DUCT SURFACES EXPOSED TO VIEW.

ii. ALL OUTSIDE AIR, EXHAUST, AND RELIEF DUCTWORK WITHIN 5 FEET OF LOUVERS SHALL BE ALUMINUM WITH SEAMS SEALED WATERTIGHT WITH ALCOA ALUMINASTIC TYPE C SEAM SEALER OR SOLDER. PITCH DUCTWORK TOWARDS LOUVER.

P. WIRE MESH SCREEN (WMS): NO. 16 USSG, 3/4 SQUARE MESH, IN 1 INCH WIDE GALVANIZED STEEL ENCLOSING FRAME. FLANGED DUCT OPENING TO RECEIVE FRAME.

Q. EXISTING DUCTWORK TO BE REUSED:

i. THIS CONTRACTOR SHALL INSPECT, SEAL PER SMACNA REQUIREMENTS, LEAK TEST, AND INSULATE ALL EXISTING DUCTWORK TO BE REUSED. EXISTING DUCTWORK TO BE REUSED SHALL CONFORM TO SPECIFICATIONS FOR NEW DUCTWORK LISTED HEREIN. ALL REQUIRED WORK SHALL BE PART OF BID.

R. EXPOSED DUCTWORK:

i. WHERE DUCTWORK IS INDICATED TO BE EXPOSED TO VIEW IN OCCUPIED SPACES, PROVIDE MATERIALS WHICH ARE FREE FROM VISUAL IMPERFECTIONS, INCLUDING PITTINGS, SEAM MARKS, STAINS, DISCOLORATIONS, AND OTHER IMPERFECTIONS. PROVIDE FINISHES WHICH WILL ALLOW PAINTING. PROVIDE FLAT TYPE SEAMS AND JOINTS FOR ALL EXPOSED DUCT CONSTRUCTION.

S. LEAKAGE TESTING:

I. ALL DUCTWORK GREATER THAN 2 INCH CLASS AS DEFINED WITHIN IS TO BE TESTED. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL COLLARS, CAPS, ELECTRIC POWER, ETC. NECESSARY TO PERFORM THE TESTS. THE CONTRACTOR IS ALSO RESPONSIBLE FOR SCHEDULING THE TEST NO LESS THAN THREE (3) BUSINESS DAYS PRIOR TO ITS INTENDED OCCURRENCE. LOW PRESSURE DUCTWORK (2 INCH CLASS) SHALL BE TESTED ON AN AS NEEDED BASIS AT THE ENGINEER'S DIRECTION. LEAKAGE TEST PROCEDURE SHALL FOLLOW THE OUTLINES AND CLASSIFICATIONS IN THE SMACNA HVAC DUCT LEAKAGE TEST MANUAL. IF SPECIMEN FAILS TO MEET ALLOTTED LEAKAGE LEVEL, THE CONTRACTOR SHALL MODIFY TO BRING IT INTO COMPLIANCE AND SHALL RETEST IT UNTIL ACCEPTABLE LEAKAGE IS DEMONSTRATED. TESTS AND NECESSARY REPAIR SHALL BE COMPLETED AND A REPORT SHALL BE SUBMITTED TO AND APPROVED BY ENGINEER PRIOR TO CONCEALMENT OF DUCTS.

9. AIR OUTLETS

A. GENERAL:

i. MARGIN TYPES, COLORS, FINISH AND METHODS OF ATTACHMENT FOR ALL DIFFUSERS, GRILLES AND REGISTERS SHALL BE COORDINATED WITH ARCHITECTURAL CEILING AND WALL DETAILS AND SPECIFICATIONS. FINISH SHALL MATCH COLOR SAMPLE AS APPROVED:

ii. FRAME TYPE SUITABLE FOR MOUNTING IN CEILING OR WALL CONSTRUCTION AS INDICATED ON ARCHITECTURAL PLANS.

iii. EXACT LOCATION OF ALL AIR OUTLETS AS PER ARCHITECTURAL PLANS.

iv. PROVIDE MOUNTING AND BLOCKING

v. SUITABLE FOR OPERATION AT 20% EXCESS AND 20% LESS THAN NOTED CAPACITY FOR CONSTANT VOLUME SYSTEMS AND AT 20% EXCESS AND 60% LESS THAN NOTED CAPACITY FOR VARIABLE VOLUME SYSTEMS.

vi. MANUFACTURER RESPONSIBLE FOR EXAMINING APPLICATION OF EACH OUTLET AND GUARANTEE THAT EACH WILL PROVIDE REQUIRED NC LEVELS AND COMFORT SPACE CONDITIONS WITHOUT DRAFTS THROUGHOUT OPERATING RANGE.

vii. ALL REGISTERS SHALL BE PROVIDED WITH OPPOSED BLADE VOLUME DAMPERS. DAMPER OPERATING LEVERS SHALL BE ACCESSIBLE AT THE FACE OF AIR OUTLETS. CEILING DIFFUSERS SHALL NOT HAVE BUTTERFLY DAMPERS WITHIN NECK.

viii. ONLY FOUR (4) WAY DIFFUSERS SHALL BE PROVIDED. PROVIDE SHEETMETAL BLANK OFF AS REQUIRED FOR 1 WAY, 2 WAY OR 3 WAY DIFFUSERS.

ix. PROVIDE BLANKING FOR PROPER COVERAGE AND BLOW WITHOUT PRODUCING OBJECTIONABLE NOISE OR AIR MOTION AT OCCUPIED LEVEL.

x. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

a) ANEMOSTAT PRODUCTS; A MESTEK COMPANY.

b) TITUS.

c) PRICE INDUSTRIES

B. LINEAR DIFFUSERS: EXTRUDED ALUMINUM CONSTRUCTION, FINISH AS PER ARCHITECT, REMOVABLE CORE, AIR DEFLECTION VANE AND CABLE DAMPER IN EACH BRANCH TAP WITH 3 FEET CABLE TO DIFFUSER FACE.

i. LINEAR DIFFUSERS: FRAME TYPES SHALL MATE WITH CEILINGS. PROVIDE MEANS TO NEATLY BUTT AND ALIGN UNITS TO GIVE CONTINUOUS APPEARANCE WITHOUT BUTTING FLANGES. NO SCREW HOLES OR WELDED CORNERS VISIBLE ON DIFFUSERS OR FRAMES WILL BE PERMITTED. AIR VOLUME SHALL BE ADJUSTABLE THROUGH AIR SUPPLY FACE WITHOUT REQUIRING REMOVAL OF FACE PANEL. PROVIDE BLANKED SECTIONS FOR INACTIVE LENGTHS. PROVIDE PLASTER FRAMES AND OPPOSED BLADE VOLUME DAMPERS WITH REMOTE CABLE OPERATORS WHERE NOTED. REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING DETAILS AND OVERALL LENGTHS.

C. SQUARE DIFFUSERS: DIFFUSERS SHALL BE STEEL CONSTRUCTION PAINTED WHITE SUITABLE FOR THE TYPE OF CEILING.

D. REGISTERS AND GRILLES:

i. RETURN AND EXHAUST REGISTERS: STEEL CONSTRUCTION WITH VOLUME DAMPER.

ii. SUPPLY REGISTERS: STEEL CONSTRUCTION ADJUSTABLE DOUBLE DEFLECTION STEEL AIRFOIL LOUVERS, WITH VOLUME DAMPER. PROVIDE AIR EQUALIZING DEFLECTOR WHERE REGISTER COLLAR DUCT IS LESS THAN 2 FEET LONG.

iii. TRANSFER GRILLES: STEEL CONSTRUCTION WITHOUT VOLUME DAMPER.

10. NOISE CONTROL

A. ALL ROOM NC LEVELS SHALL BE 35 OR LESS.

B. PROVIDE SOUNDLINING FOR THE FOLLOWING DUCTWORK:

i. ALL DUCTWORK WITHIN MECHANICAL ROOMS AND NOT LESS THAN 25 FEET ON

EACH SIDE OF ALL FANS AND AC UNITS.

ii. ALL AIR TRANSFER AND JUMPER DUCTS.

iii. RETURN AIR STUB DUCTS AT MER WALLS AND SHAFT INTAKE OPENINGS FOR FULL LENGTH.

iv. DOWNSTREAM OF ALL TERMINAL BOXES (CV, VAV) FOR A MINIMUM OF 15 FEET).

v. ALL MIXED AIR PLENUMS, EXCEPT WHERE MOISTURE CARRYOVER FROM OUTDOOR AIR LOUVER WILL OCCUR.

vi. EXPOSED SUPPLY DUCTWORK SHALL BE ACOUSTICALLY LINED IN LIEU OF EXTERNAL INSULATION.

vii. ALSO WHERE NOTED ON A DRAWING.

C. SOUNDLINING IN DUCTWORK: FIBROUS GLASS, MINIMUM 3 LB DENSITY, 1-1/2 INCH THICKNESS, MAXIMUM 0.25 K FACTOR AT 75°F MEAN TEMPERATURE WITH ACRYLIC COATED FINISH FACTORY APPLIED EDGE COATING AND STENCILED IN ACCORDANCE WITH NFPA 90. FLAMESPREAD SHALL BE A MAXIMUM OF 25. LINING SHALL NOT SUPPORT MICROBIAL GROWTH AND SHALL BE TESTED IN ACCORDANCE WITH ASTM C 1071 AND ASTM G21/G22. SIMILAR TO MANVILLE PERMACOTE LINACOUSTIC.

D. ALL SOUNDLINING, ADHESIVES, FACES AND ACCESSORIES TO BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, EXCEPT AS OTHERWISE NOTED.

11. TESTING AND BALANCING

A. ALL AIR AND WATER BALANCING SHALL BE BY AN INDEPENDENT CONTRACTOR NOT AFFILIATED WITH THE MECHANICAL CONTRACTOR AND IN ACCORDANCE WITH LOCAL STANDARDS. CONTRACTOR SHALL UTILIZE BASE BUILDING BALANCING CONTRACTOR OR APPROVED EQUAL, CONTACT BUILDING MANAGEMENT.

B. CONTRACTOR TO BALANCE ENTIRE SYSTEM TO AIR AND/OR WATER QUANTITIES AS SHOWN ON ALL RELATED DRAWINGS FOR THIS JOB, AND AS DESCRIBED HEREIN. BALANCING MUST BE DONE IN THE PRESENCE OF A BUILDING ENGINEER.

C. AIR BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF FANS AND BRANCH DAMPERS FOR MAJOR ADJUSTMENTS. AIR SUPPLY OUTLETS TO BE BALANCED TO A UNIFORM SUPPLY ACROSS ENTIRE FACE. ADJUSTMENT OF TERMINAL DAMPERS AND DEVICES SHALL BE FOR TRIM OR MINOR ADJUSTMENT ONLY. THIS SHALL BE DONE TO PERMIT THE LEAST NOISE GENERATION IN THE TERMINAL AREAS AND UTILIZE MINIMUM FAN ENERGY.

D. WATER BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF BALANCING VALVES

AT PUMPS FOR PROPER FLOW. ADJUST FLOW THROUGH COILS AS REQUIRED.

E. UPON COMPLETION OF THE INSTALLATION, THE CONTRACTOR SHALL REBALANCE ANY EXISTING PORTIONS OF AIR DISTRIBUTION SYSTEM AND WATER DISTRIBUTION SYSTEM AFFECTED BY THE RENOVATION AND ALSO BALANCE ALL NEW WORK.

F. IF DISCREPANCIES EXIST IN THE REPORT THAT REQUIRE FIELD VERIFICATION, THE TESTING AND BALANCING COMPANY IN THE PRESENCE OF THE ENGINEER SHALL VISIT THE JOBSITE FOR FIELD VERIFICATION OF THE REPORT.

G. THE CONTRACTOR SHALL PROVIDE ALL LABOR, PRESSURE GAUGES, FLOW METERS, SHEAVES, AND BELTS REQUIRED TO BALANCE SYSTEMS.

H. BALANCING REPORT SHALL BE PROVIDED ON NEBB OR AABC-TYPE FORMS.

I. BALANCING AND TESTING SHALL BE PERFORMED AND SUPERVISED BY A CERTIFIED NEBB OR AABC TECHNICIAN.

J. BALANCING AND TESTING SHALL BE PERFORMED AND SUPERVISED BY ONE OF THE FOLLOWING INDEPENDENT FIRMS SPECIALIZING IN TESTING AND BALANCING:

I. INTERNATIONAL TESTING AND BALANCING

II. INDEPENDENT TESTING & BALANCING

III. MERENDINO ASSOCIATES.

K. THE PERFORMANCE AND CAPACITY OF ALL SYSTEMS AND EQUIPMENT TO BE DEMONSTRATED BY THE CONTRACTOR.

L. AFTER SUBMISSION OF THE FIELD VERIFIED BALANCING REPORT, THE AIR BALANCING COMPANY SHALL RETURN TO THE JOB SITE TO PERFORM TWO (2) OCCUPANT COMFORT BALANCES AS DIRECTED BY THE OWNER OR ENGINEER

M. THE FINAL REPORT AFTER THE COMFORT BALANCE IS TO BE INCLUDED IN PROJECT OPERATING AND MAINTENANCE MANUAL TO OWNER AND ENGINEER.

N. THE TESTING AND BALANCING AGENCY SHALL INCLUDE AS PART OF THEIR WORK AN EXTENDED WARRANTY OF 90 DAYS AFTER COMPLETION OF TEST AND BALANCE WORK. THE ENGINEER AT HIS DISCRETION DURING THE WARRANTY PERIOD MAY REQUEST A RECHECK, OR RESETTING OF ANY EQUIPMENT. THE MECHANICAL CONTRACTOR AND THE BALANCING CONTRACTOR SHALL PROVIDE THE NECESSARY TECHNICIANS TO FACILITATE THIS WORK.

O. BALANCING AGENCY SHALL PERMANENTLY MARK ALL ADJUSTMENT DEVICES (VALVES, DAMPERS, ETC.) TO ENABLE THE SETTING TO BE RESTORED.

P. AIR BALANCING:

i. PRE-CONSTRUCTION AIR TESTING: MEASURE PRESSURE, TEMPERATURE, AND VOLUME OF AIR FROM EXISTING BASE BUILDING SYSTEM BEFORE STARTING WORK. TRAVERSE MAIN SUPPLY AND RETURN DUCTS BEFORE WORK TO OBTAIN TOTAL FLOW. SUBMIT REPORT TO ENGINEER IMMEDIATELY AFTER COMPLETION OF TEST.

ii. HVAC CONTRACTOR SHALL ENSURE THAT A FIRST SET OF AIR FILTERS ARE IN PLACE, WHENEVER FANS ARE RUNNING AND REPLACED WITH A NEW CLEAN SET OF FILTERS BEFORE TESTING IS COMMENCED.

iii. TEST, ADJUST, REPLACE SHEAVES, AND BALANCE ALL EQUIPMENT AND AIR DISTRIBUTION SYSTEMS TO PROVIDE AIR QUANTITIES INDICATED ON PLANS WITHIN PLUS OR MINUS 5 PERCENT.

iv. TEST REPORT SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

a) FLOW, LEAKAGE CLASS, TEMPERATURE, STATIC PRESSURE OF AIR AT ALL TRUNK DUCTS SERVING AREAS OF WORK.

b) TEMPERATURE OF AIR LEAVING OUTLETS AT TWO (2) TYPICAL AIR OUTLETS.

c) QUANTITY OF AIR AT EACH AIR INLET AND OUTLET AFTER BALANCING.

d) PROVIDE FOR ALL FANS, FAN MOTOR HP, AMPS, VOLTS, FAN RPM, CFM, INLET AND DISCHARGE STATIC PRESSURE, SHEAVE POSITION.

e) PROVIDE FOR ALL AIR CONDITIONING UNITS, SUPPLY CFM, OUTSIDE AIR CFM, RETURN AIR CFM, MIXED AIR CFM. PROVIDE OUTSIDE AIR, MIXED AIR AND SUPPLY AIR TEMPERATURES (DRY BULB - COOLING AND HEATING, WET-BULB-COOLING.) INDICATE UNIT OPERATING MODE DURING TEST.

f) CALIBRATE ALL NEW TERMINAL BOXES (VAV) AS REQUIRED TO MEET SPECIFIED MINIMUM/MAXIMUM CFM.

g) LISTING OF DESIGN AND ACTUAL READINGS AS WELL AS ALL MANUFACTURER'S DATA FOR EQUIPMENT.

Q. WATER BALANCING:

i. TEST, ADJUST, AND BALANCE NEW AND EXISTING TO BE REUSED DISTRIBUTION SYSTEMS TO PROVIDE FLOW QUANTITIES INDICATED ON THE DRAWINGS WITHIN PLUS OR MINUS 2 PERCENT.

ii. PLACE SYSTEM IN FULL AUTOMATIC OPERATION, WITH AUTOMATIC CONTROLS SET IN ACCORDANCE WITH DESIGN CONDITIONS, AND ALLOW WATER TO REACH DESIGN TEMPERATURE AND PRESSURE.

iii. ALL PIPE TESTING SHALL BE COMPLETED BEFORE COMMENCING BALANCING.

iv. SET ZONE OR CIRCUIT BALANCING VALVES AT EACH PIECE OF EQUIPMENT (PUMP, AIR HANDLING UNIT, ETC.), TO HANDLE THE DESIGN FLOW.

v. AIR HANDLING UNITS CONTAINING COILS, CHECK AND ADJUST EACH UNIT TO ENSURE THE PROPER VOLUME OF AIR IS PASSING THROUGH THE COILS, WHILE THE BALANCING PROCEDURE IS IN PROGRESS.

vi. THE TEST REPORT SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:

a) THE PRESSURE DROP ACROSS AND FLOW AT EACH PIECE OF EQUIPMENT AND AT EACH RISER AND MAIN.

b) TEST PUMPS AND BALANCE FLOW. RECORD THE FOLLOWING ON PUMP REPORT SHEETS:

(1) PUMP IDENTIFICATION AND SYSTEM SERVED.
(2) SUCTION AND DISCHARGE PRESSURE AT OPERATING CONDITIONS.
(3) RUNNING AMPS AND BRAKE HORSEPOWER OF PUMP MOTOR UNDER FULL FLOW AND NO FLOW CONDITIONS.
(4) PRESSURE DROP ACROSS PUMP IN FEET OF WATER OR PSIG AND TOTAL GPM PUMP IS HANDLING UNDER FULL FLOW CONDITIONS.
(5) IF THE PUMPS HAVE VARIABLE FREQUENCY DRIVES FOR BALANCING OR OPERATE IN DIFFERENT MODES, THE BALANCING CONTRACTOR SHALL SET THE DRIVE TO PROVIDE REQUIRED FLOW AND COORDINATE WITH THE CONTROLS CONTRACTOR.

vii. PROVIDE FLOW DIAGRAMS INDICATING PIPING LAYOUT, FLOW BALANCING VALVES AND WHERE THE READING OF EACH INDIVIDUAL PIECE OF EQUIPMENT HAS BEEN TAKEN.

viii. MARK VALVE TAG AFTER BALANCING OF EACH BALANCING VALVE TO INDICATE POSITION OF VALVE.

12. INSULATION - GENERAL REQUIREMENTS

A. ALL INSULATION MATERIALS, INCLUDING JACKETS, FACING, ADHESIVE, COATINGS, AND ACCESSORIES ARE TO BE FIRE HAZARD RATED AND LISTED BY UNDERWRITERS LABORATORIES, INC. USING STEINER TUNNEL TEST METHOD FOR FIRE HAZARD

CLASSIFICATION OF BUILDING MATERIALS, STANDARD UL 723 (ASTM E-84), (ASA A2.5-1963). FLAMESPREAD: MAXIMUM 25. FUEL CONTRIBUTED AND SMOKE DEVELOPED: MAXIMUM 50. FLAMEPROOFING TREATMENTS SUBJECT TO DETERIORATION FROM MOISTURE OR HUMIDITY ARE NOT ACCEPTABLE.

B. PRODUCTS SHALL NOT CONTAIN ASBESTOS, LEAD, MERCURY, OR MERCURY COMPOUNDS.

C. DEFINITIONS:

i. EXPOSED: INDOOR DUCTS, PIPING OR EQUIPMENT LOCATED IN MECHANICAL EQUIPMENT ROOMS AND IN AREAS WHICH WILL BE VISIBLE WITHOUT REMOVING CEILINGS OR OPENING ACCESS PANELS.

ii. CONCEALED: INDOOR DUCTS, PIPING OR EQUIPMENT WHICH IS NOT EXPOSED.

iii. OUTDOOR: DUCTS, PIPING OR EQUIPMENT WHICH IS EXPOSED TO THE WEATHER.

13. DUCTWORK INSULATION

A. INSULATE ALL DUCTWORK IN ACCORDANCE WITH INSULATION SCHEDULE ON M-600 DRAWING EXCEPT AS OTHERWISE NOTED.

B. REINSULATE ALL DUCTWORK AND PIPING WHICH IS EXISTING AND DAMAGED DURING CONSTRUCTION OR REQUIRED TO BE RELOCATED. INSULATE WITH SAME MATERIAL AND THICKNESS.

C. NON-INSULATED DUCTWORK:

i. WHERE SOUNDLINING IS OF MINIMUM THICKNESS SPECIFIED FOR INSULATION.

ii. AIR CONDITIONING RETURN AIR DUCTWORK EXPOSED IN AIR CONDITIONED SPACES AND INSTALLED IN HUNG CEILINGS WHERE SPACE IMMEDIATELY ABOVE AND BELOW ARE BOTH AIR CONDITIONED.

D. OUTDOOR DUCTWORK

i. FOR OUTDOOR DUCTWORK OR DUCTWORK EXPOSED TO THE ELEMENTS IN ADDITION TO INSULATION AND FINISHES SPECIFIED FOR INDOOR DUCTWORK, APPLY TWO (2) COATS OF WEATHERPROOF MASTIC AND EMBED INTO WET COAT TWO (2) LAYERS OF GLASS CLOTH OVER INSULATION JACKET. SMOOTH MEMBRANE TO AVOID WRINKLES AND OVERLAP ALL SEAMS AT LEAST 3 INCH. APPLY A SECOND COAT OF SAME COATING TO THE ENTIRE SURFACE. TOP CENTER OF RECTANGULAR DUCT SHALL PITCH TO EACH SIDE TO AVOID TRAPPING OF WATER IN THE CENTER.

E. MATERIAL:

i. TYPE D-1: MINIMUM 1-LB DENSITY FIBERGLASS BLANKET, MAXIMUM 0.28 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY-APPLIED FOIL-SKRIM-KRAFT FACING SIMILAR TO MANVILLE MICROLITE.

ii. TYPE D-2: 3 LB. FIBERGLASS BOARD. THE MAXIMUM K FACTOR SHALL BE 0.23 AT 75°F MEAN TEMPERATURE WITH A MINIMUM DENSITY OF 3 LB. THE INSULATION SHALL BE PROVIDED WITH A FACTORY-APPLIED ALL PURPOSE OR ALL SERVICE FACING. THE INSULATION SHALL BE EQUAL TO MANVILLE TYPE 814 SPIN-GLAS AP.

iii. TYPE D-3: MINIMUM 6 LB FIBERGLASS BOARD. MAXIMUM 0.22 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY APPLIED ALL PURPOSE OR ALL SERVICE FACING. SIMILAR TO MANVILLE 817 SPIN-GLAS AP.

F. INSTALLATION:

i. FIBERGLASS BLANKET: 2 INCH LAP STRIPS AT ALL SEAMS. SECURE BOTTOM OF ALL DUCTS OVER 24 INCH WIDE WITH MIN. 2 ROWS OF WELD PINS 12 INCH ON CENTER. SECURE ALL SEAMS WITH FOIL VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE.

ii. FIBERGLASS BOARD: SEAL JOINTS AND BREAKS IN FACING WITH 3 INCH WIDE TAPE TO MATCH FACING AND ADHERE WITH VAPOR SEAL ADHESIVE. APPLY 5 INCH WIDE TAPE AT CORNERS, WELD PINS ON TOP, SIDES AND BOTTOM.

14. PIPING INSULATION

A. INSULATE ALL PIPING IN ACCORDANCE WITH INSULATION SCHEDULE ON M-600 DRAWING EXCEPT AS OTHERWISE NOTED.

B. PIPING, VALVES AND FITTINGS TO BE INSULATED:

i. LOW TEMPERATURE PIPING SYSTEMS, 40 TO 100°F INCLUDING

a) CHILLED WATER SUPPLY AND RETURN.

b) CONDENSER WATER SUPPLY AND RETURN.

c) GLYCOL WATER SUPPLY AND RETURN.

d) CONDENSATE DRAIN PIPING.

ii. LOW TEMPERATURE HOT PIPING SYSTEMS, 100 TO 250°F INCLUDING

a) LOW TEMPERATURE HOT WATER SUPPLY AND RETURN.

b) LOW PRESSURE STEAM SUPPLY TO 15 PSIG.

c) LOW PRESSURE CONDENSATE RETURN, EXCEPT STEAM TRAPS AND TRAP ASSEMBLY AND RADIATION RUNOUTS CONCEALED IN RADIATION ENCLOSURES.

d) PUMPED CONDENSATE DISCHARGE.

C. MATERIAL

i. TYPE P-1: MINIMUM 4 LB DENSITY MOLDED FIBERGLASS, MAXIMUM 0.23 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY-APPLIED FIRE-RETARDANT FOIL-SKRIM-KRAFT FACING. ALL SERVICE JACKET. SIMILAR TO OWENS-CORNING 650 ASJ.

ii. TYPE P-4: MINIMUM 1 LB DENSITY FIBERGLASS FITTING INSERTS, MAXIMUM 0.28 K-FACTOR AT 75°F MEAN TEMPERATURE SIMILAR TO MANVILLE HI-LO TEMP INSULATION INSERTS.

iii. TYPE P-6: MINIMUM 6 LB MOLDED FOAMED PLASTIC. MAXIMUM 0.27 K-FACTOR AT 75°F MEAN TEMPERATURE. MAXIMUM 0.17 PERMEANCE. SIMILAR TO ARMSTRONG ARMAFLEX II.

D. FINISH:

i. TYPE F-1: FITTING COVER, MOLDED WHITE PVC JACKET, UL CLASS 1, MAXIMUM PERMEANCE 0.05 SIMILAR TO MANVILLE ZESTRON.

ii. TYPE F-4: PVC JACKETING WITH MINIMUM 0.016 INCH WALL THICKNESS AND LONGITUDINAL JOINTS WITH LOCK SEAMS.

E. OUTDOOR PIPING:

i. FOR ALL PIPING, FITTINGS AND VALVES LOCATED OUTDOORS, INCREASE SCHEDULED INSULATION THICKNESS BY A MINIMUM OF 1 INCH AND PROVIDE F-4 FINISH. PROVIDE VAPORSEAL ON ALL OUTDOOR PIPES, VALVES AND FITTINGS SUBJECT TO CONDENSATION.

ii. COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL HEAT TRACING REQUIREMENTS AND PIPING LENGTH REQUIREMENTS. ELECTRICAL TO PROVIDE CABLING AND THERMOSTAT.

F. INSTALLATION:

i. BEFORE APPLYING INSULATION ALL PRESSURE AND LEAK TESTS SHALL BE COMPLETED AND APPROVED.

ii. ALL INSULATION SHALL BE BUTTED FIRMLY TOGETHER. PROVIDE 2 INCH LAMP

STRIPS AT ALL SEAMS SECURED WITH ADHESIVE. USE VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE WHERE REQUIRED. STAPLES NOT PERMITTED. REFRIGERANT PIPING INSULATION SHALL HAVE MITERED FITTINGS.

iii. ALL INSULATION AND VAPOR BARRIERS SHALL BE CONTINUOUS PASSING THROUGH SLEEVES, HANGERS, ETC., OR OTHER OPENINGS. PROVIDE SADDLES OR SHIELDS FOR PROTECTION.

iv. INSULATION FOR STRAINERS OR OTHER FITTINGS OR ACCESSORIES REQUIRING SERVICING OR INSPECTION SHALL HAVE INSULATION REMOVABLE AND REPLACEABLE WITHOUT DAMAGE.

15. FIRE-RATED INSULATION SYSTEMS

A. FIRE-RATED BOARD: STRUCTURAL-GRADE, PRESS-MOLDED, XONOLITE CALCIUM SILICATE, FIREPROOFING BOARD SUITABLE FOR OPERATING TEMPERATURES UP TO 1700°F. COMPLY WITH ASTM C 656, TYPE II, GRADE 6. TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING BY A NRTL ACCEPTABLE TO AUTHORITY HAVING JURISDICTION. MANUFACTURERED BY JOHNS MANVILLE; SUPER FIRETEMP M.

B. FIRE-RATED BLANKET: HIGH-TEMPERATURE, FLEXIBLE, BLANKET INSULATION WITH FSK JACKET THAT IS TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING BY A NRTL ACCEPTABLE TO AUTHORITY HAVING JURISDICTION. MANUFACTURED BY JOHNS MANVILLE; FIRETEMP WRAP; FIREMASTER DUCT WRAP, 3M; FIRE BARRIER WRAP PRODUCTS, UNIFRAX CORPORATION; FYREWRAP.

C. NYC PROJECTS: PRODUCT SHALL HAVE LISTING FOR THE PARTICULAR APPLICATION

16. VIBRATION ISOLATION

A. FURNISH AND INSTALL ALL NECESSARY VIBRATION ISOLATORS, VIBRATION HANGERS, MOUNTING PADS, RAILS, ETC., TO ISOLATE VIBRATION AND SOUND FROM BEING TRANSMITTED TO THE BUILDING STRUCTURE. ALL VIBRATION PRODUCTS SHALL BE SPECIFICALLY DESIGNED FOR THEIR INTENDED USE. PROVIDE ISOLATION FOR MOTORIZED EQUIPMENT.

B. MANUFACTURER OF THE VIBRATION ISOLATION EQUIPMENT SHALL HAVE THE FOLLOWING RESPONSIBILITIES

i. SUBMIT TYPE, SIZE, DEFLECTION, LOCATION AND DETAILS INCLUDING FREE HEIGHT FOR EACH ISOLATOR PROPOSED FOR ITEMS IN THE SPECIFICATION AND ON THE DRAWINGS.

ii. SUBMIT DETAILS OF ALL STEEL FRAMES AND CONCRETE INERTIA BASES TO BE USED IN CONJUNCTION WITH THE ISOLATION IN THIS SPECIFICATION AND IN THE DRAWINGS.

iii. CLEARLY OUTLINE THE PROCEDURES FOR INSTALLING AND ADJUSTING THE

ISOLATORS OR HANGERS.

iv. GUARANTEE THE SPECIFIED ISOLATION SYSTEMS DEFLECTION AND THAT A MINIMUM OF 90% EFFICIENCY WILL BE OBTAINED.

C. THE FOLLOWING ARE APPROVED MANUFACTURERS, PROVIDED THEIR SYSTEMS STRICTLY COMPLY WITH THE DESIGN INTENT FOR PERFORMANCE, DEFLECTION AND STRUCTURAL CAPACITY OF THIS SPECIFICATION.
   I. MASON INDUSTRIES, INC., HAUPPAUGE, NY
   II. VIBRATION MOUNTINGS & CONTROLS, INC., BLOOMINGDALE, NJ
   III. AMBER BOOTH, HOUSTON, TX
   IV. KINETICS NOISE CONTROL, INC

D. PROVIDE INSTALLATION INSTRUCTIONS, DRAWINGS AND FIELD SUPERVISION TO ASSURE PROPER INSTALLATION AND PERFORMANCE.

E. INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS INCLUDING THE LOAD AND SPRING STATIC DEFLECTION FOR EACH FLOOR OR CEILING HUNG ISOLATOR.

F. PROVIDE LEVELING DEVICES AND APPROVED RESILIENT DEVICES AS REQUIRED TO LIMIT EQUIPMENT AND PIPING MOTION IN EXCESS OF 1/4 INCH ISOLATORS SHALL HAVE CAPABILITY OF SUPPORTING EQUIPMENT AND PIPING AT A FIXED ELEVATION DURING INSTALLATION AND AT A SPECIFIED HEIGHT AFTER ADJUSTMENT.

G. ALL SPRINGS SHALL HAVE AT LEAST 50% ADDITIONAL LOAD CAPACITY ABOVE DESIGN LOAD.

H. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE EQUIPMENT CANNOT SUPPORT POINT LOADS.

I. PROVIDE CORROSION PROTECTION FOR EQUIPMENT MOUNTED OUTDOORS. SPRING CORROSION RESISTANCE SHALL BE POWDER COATING OF THE SPRING WITH THE STEEL HOUSING HOT DIPPED GALVANIZED. ALL HARDWARE TO BE CADMIUM PLATED.

J. CENTRIFUGAL FANS

   i. FLOOR MOUNTED AXIAL FANS, CABINET FANS, FAN SECTIONS, AIR HANDLING UNITS UTILIZE MASON TYPE SLF FREE STANDING SPRING OR EQUAL.

   ii. CEILING HUNG UTILIZE MASON TYPE 30 N OR EQUAL.

   iii. 3 HP AND LESS MOTOR TYPE B-1 BASE WITH SPRING ISOLATORS MASON TYPE SLF SPRING ISOLATORS OR EQUAL.

   iv. 24 INCH DIAMETER AND UP, WITH UP TO 40 HP MOTOR-TYPE B-1 BASE WITH MASON TYPE SLF SPRING ISOLATORS OR EQUAL.

   v. MOTOR SIZE - MINIMUM CONCRETE THICKNESS

a) 5 TO 15 HP - 6 INCHES

b) 20 TO 50 HP - 8 INCHES

K. FLOOR MOUNTING OF PACKAGED AIR CONDITIONING UNIT WITH INTERNAL ISOLATION FOR COMPRESSORS - NEOPRENE IN SHEAR - TYPE SUPER W- BRIDGE BEARING.

i. 50 PSI MAXIMUM LOADING. PROVIDE STEEL BEARING PLATE TO DISTRIBUTE LOAD WHERE REQUIRED.

L. ROOFTOP AC UNITS - SPRING ROOF CURB - TYPE RSC AND/OR DUNNAGE STEEL WITH TYPE SLR WITH VERTICAL LIMIT STOPS.

M. SUPPORT OF PIPING IN EQUIPMENT ROOMS AND WHERE EXPOSED ON ROOF

i. ALL WATER PIPING OUTSIDE OF SHAFTS WITHIN 50 FEET OF CONNECTED ROTATING EQUIPMENT TO BE SUPPLIED WITH ISOLATORS.

ii. HANGER ROD ISOLATORS (TYPE 30N) MOUNTINGS.

iii. INDOOR SUPPORTED PIPING ISOLATORS (TYPE SLR).

iv. VERTICAL RISER PIPING ANCHOR AND GUIDES (TYPE ADA).

N. FLOOR AND ROOF MOUNTING OF FACTORY ASSEMBLED AIR HANDLING UNITS, AIR CONDITIONING UNITS, HEAT EXCHANGERS AND CONDENSING UNITS, - SPRING ISOLATORS (ROOF MOUNTED EQUIPMENT TYPE SLR), OR (INDOOR EQUIPMENT TYPE SLF).

O. PROVIDE FLEXIBLE CONNECTIONS BETWEEN ALL FANS AND DUCTWORK (REFER TO DUCTWORK SECTION FOR SPECIFICATIONS).

17. PIPING - GENERAL REQUIREMENTS

A. COMPLETE WITH: PIPE, FITTINGS, VALVES, STRAINERS, MOTORIZED VALVE OPERATORS, HANGERS, SUPPORTS, GUIDE, SLEEVES, AND ACCESSORIES.

B. ALL ITEMS SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH THE LATEST EDITIONS OF THE FOLLOWING CODES AND STANDARDS:

i. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME).

ii. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).

iii. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).

iv. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING

INDUSTRY (MSS).

C. GASKETS: ONE PIECE RING TYPE 1/16 INCH MINIMUM THICKNESS KLINGER C4400 ONLY (OR APPROVED EQUAL, SUBMIT FOR APPROVAL BEFORE USE).

D. WELDING

i. ALL WELDING SHALL BE DONE IN ACCORDANCE WITH ALL CODES APPLICABLE TO THE PARTICULAR SERVICE. 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.

ii. COMPLY WITH SECTION II, PART C OF THE ASME BOILER AND PRESSURE VESSEL CODE FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND FOR CHEMICAL ANALYSIS OF PIPE BEING WELDED.

iii. QUALIFY PROCESSES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX, “WELDING AND BRAZING QUALIFICATIONS”. COMPLY WITH PROVISIONS IN ASME B31 SERIES, "CODE FOR PRESSURE PIPING."

iv. WELDERS SHALL BE QUALIFIED FOR ALL REQUIRED PIPE SIZES, MATERIAL, WALL THICKNESS, AND POSITION IN ACCORDANCE WITH THE AMERICAN SOCIETY OF MECHANICAL ENGINEERING (ASME) SECTION IX, BOILER AND PRESSURE VESSEL CODE. CERTIFY THAT EACH WELDER HAS PASSED AWS QUALIFICATION TESTS FOR WELDING PROCESSES INVOLVED AND THAT CERTIFICATION IS CURRENT.

v. COPIES OF THE CERTIFIED WELDER QUALIFICATION REPORTS SHALL BE MAINTAINED BY THE RESPONSIBLE WELDING AGENCY AND THE COMPANY PERFORMING THE WELDING, AND SHALL BE SUBMITTED TO THE OWNER AND/OR ENGINEER UPON REQUEST.

vi. ALL DEFECTIVE WELDS SHALL BE CHIPPED OUT AND REPAIRED AT NO COST TO THE OWNER, BASED ON PROCEDURE TO BE SPECIFIED AT THE TIME.

E. COPPER TUBE BRAZING

i. ALL BRAZING SHALL BE DONE IN ACCORDANCE WITH ALL CODES APPLICABLE TO THE PARTICULAR SERVICE. BRAZING FILLER METALS: AWS A5.8, BCUP SERIES, COPPER-PHOSPHORUS ALLOYS FOR JOINING COPPER WITH COPPER; OR BAG-1, SILVER ALLOY FOR JOINING COPPER WITH BRONZE OR STEEL.

ii. QUALIFY PROCESS AND OPERATORS IN ACCORDANCE WITH ASME BOILER AND PRESSURE VESSEL CODE, SECTION IX, “WELDING AND BRAZING QUALIFICATIONS”.

iii. BRAZERS SHALL BE QUALIFIED FOR ALL REQUIRED TUBE SIZES, MATERIAL, WALL THICKNESS, AND POSITION IN ACCORDANCE WITH THE AMERICAN SOCIETY OF

MECHANICAL ENGINEERING (ASME), SECTION IX, BOILER AND PRESSURE VESSEL CODE.

iv. COPIES OF THE CERTIFIED BRAZER QUALIFICATION REPORTS SHALL BE MAINTAINED BY THE RESPONSIBLE BRAZING AGENCY AND THE COMPANY PERFORMING THE BRAZING, AND SHALL BE SUBMITTED TO THE OWNER AND/OR ENGINEER UPON REQUEST.

v. ALL DEFECTIVE BRAZEMENTS SHALL BE CHIPPED OUT AND REPAIRED AT NO COST TO THE OWNER, BASED ON PROCEDURE TO BE SPECIFIED AT THE TIME.

F. GASKETS

i. PIPE-FLANGE GASKET MATERIALS: SUITABLE FOR CHEMICAL AND THERMAL CONDITIONS OF PIPING SYSTEM CONTENTS. ASME B16.21, NONMETALLIC, FLAT, ASBESTOS-FREE, 1/8-INCH MAXIMUM THICKNESS UNLESS THICKNESS OR SPECIFIC MATERIAL IS INDICATED.

G. ALL PRESSURIZED HYDRONIC PIPING TO BE TESTED HYDROSTATICALLY TO 150 PSI OR 150% OF OPERATING PRESSURE, WHICHEVER IS GREATER, BUT NEVER EXCEED TEST PRESSURE ANSI B16.1 BASIS. TEST DURATION TO BE 2 HOURS WITH NO PRESSURE CHANGE CORRECTED FOR TEMPERATURE CHANGE. REPAIR OR REPLACE LEAKS OR DEFECTS WITHOUT ADDITIONAL COST.

i. REFRIGERANT PIPING

a) TEST REFRIGERANT PIPING FOR TIGHTNESS AND LEAKS UNDER PRESSURE OR VACUUM - COORDINATE WITH MANUFACTURER REQUIREMENTS. THE DURATION OF EACH TEST SHALL BE TWENTY-FOUR (24) HOURS.

b) TEST JOINTS IN ACCORDANCE WITH ASHRAE 15-LATEST EDITION. THERE SHALL BE NO OBSERVABLE LEAKS OR CHANGES IN PRESSURE. IF EITHER IS OBSERVED, SEAL LEAKS, AND REPEAT TEST PROCEDURES

H. SYSTEM FILLING

i. SYSTEMS OR PORTIONS OF SYSTEMS TO BE TESTED SHALL HAVE PROVISIONS FOR FILLING, VENTING (AIR REMOVAL), DRAINAGE AND TEST PRESSURE CONNECTION.

ii. LIQUID USED FOR TESTING SHALL BE CLEAN CITY WATER MIXED WITH CHEMICALS SPECIFIED BY THE BASE BUILDING WATER TREATMENT CONTRACTOR. THE HVAC CONTRACTOR SHALL HIRE THE SERVICES OF THE BUILDING WATER TREATMENT CONTRACTOR AND PROVIDE ALL REQUIRED LABOR. PROVIDE TEMPORARY METERING AND MIXING DEVICES AS REQUIRED. THE HVAC CONTRACTOR SHALL OBTAIN ALL REQUIREMENTS FROM THE BUILDING MANAGEMENT.

I. FLUSHING AND CLEANING AND TREATMENT

i. AFTER COMPLETION OF HYDROSTATIC TESTS AND EMPTYING, PROVIDE LABOR FOR INITIAL FLUSHING, CLEANING, AND PASSIVATING IN ACCORDANCE WITH THE OWNER'S WATER TREATMENT SPECIFICATION. THE HVAC CONTRACTOR SHALL HIRE THE SERVICES OF THE BASE BUILDING WATER TREATMENT CONTRACTOR. COORDINATE WITH THE OWNER'S WATER TREATMENT COMPANY AND PROVIDE ALL SPECIFICATION REQUIREMENTS AND REQUIRED LABOR. COORDINATE ALL REQUIREMENTS WITH BASE BUILDING MANAGEMENT FOR BASE BUILDING VENDOR.

ii. PROVIDE ONE YEAR'S SUPPLY OF NECESSARY WATER TREATMENT CHEMICALS FOR NEW SYSTEM TO THE OWNER OR TENANT INCLUDING THE FOLLOWING:

iii. CLOSED SYSTEM TREATMENT (CHILLED WATER, SECONDARY WATER, CLOSED CONDENSER WATER AND HOT WATER). PROVIDE AGENTS TO REDUCE SCALE DEPOSITS, TO ADJUST PH AND TO INHIBIT CORROSION. TREATMENT SHALL NOT CONTAIN ANY CHROMATE'S OR OTHER TOXIC SUBSTANCES. USE PROPER CHEMISTRY TO PROVIDE BACTERIA COUNTS BELOW 10^3 COLONIES PER MILLILITER (AEROBIC & NON AEROBIC). PH LEVELS TO BE BETWEEN 7.0 AND 9.0. CORROSION RATE TO BE LESS THAN 1/2 MILS/YEAR STEEL, 1/10 MILS/YEAR COPPER.

iv. OPEN SYSTEM TREATMENT (CONDENSER WATER) PROVIDE AGENTS TO REDUCE SCALE DEPOSITS, TO ADJUST PH AND TO INHIBIT CORROSION. TREATMENT SHALL NOT CONTAIN ANY CHROMATE'S OR OTHER TOXIC SUBSTANCES. USE PROPER CHEMISTRY TO PROVIDE BACTERIA COUNTS BELOW 10^5 COLONIES PER MILLIMETER (AEROBIC AND NON-AEROBIC). PH TO BE BETWEEN 7.5 AND 8.5. CORROSION RATES TO BE LESS THAN 1 MILS/YEAR -STEEL AND 1/10 MILS/YEAR COPPER.

J. PROVIDE DIELECTRIC FITTINGS WHERE DISSIMILAR METALS ARE TO BE JOINED.

K. HOT (WET) TAPS:

i. PROVIDE NEW HOT (WET) TAP CONNECTIONS INTO PIPING SYSTEMS AS INDICATED ON THE PLANS.

ii. PROVIDE ALL REQUIRED EQUIPMENT AND MATERIALS SUCH AS A TAPPING MACHINE, WELDING MACHINE, FULL PORTED VALVE AND A PRESSURE CONTAINING FITTING. VALVE AND PRESSURE FITTING TO BE RATED FOR THE WORKING PRESSURE OF THE PIPING SYSTEM.

iii. HOT TAP TO BE PERFORMED BY A QUALIFIED CONTRACTOR WHO IS SPECIALIZED IN PERFORMING THIS TYPE OF WORK. CONTRACTORS NAME SHALL BE SUBMITTED TO THE OWNER, OWNER'S REPRESENTATIVE, BUILDING MANAGEMENT AND ENGINEER FOR APPROVAL PRIOR TO COMMENCING

WORK.

iv. HOT (WET) TAP COUPON IS TO BE TURNED OVER TO BUILDING MANAGEMENT.

L. DRAIN DOWN FOR NEW PIPING CONNECTION INTO EXISTING:

i. CONTRACTOR TO OBTAIN SCHEDULE AND COORDINATE WITH BUILDING MANAGEMENT FOR SYSTEM DRAIN DOWN AND CONNECTION INTO EXISTING BUILDING PIPING. ALL COSTS ASSOCIATED WITH DRAIN DOWN ARE TO BE INCLUDED AS PART OF BID.

M. ALL INSTRUMENTATION (PRESSURE GAUGES AND THERMOMETERS) SHALL BE RATED FOR THE SAME PRESSURE AND TEMPERATURE AS PIPING SYSTEM AND RATED SPECIFICALLY FOR THE SAME SERVICE AS THE PIPING. PRESSURE GAUGES ARE TO BE LIQUID FILLED WITH 1% ACCURACY. SELECT GAUGES AND THERMOMETERS SO THAT THE MID-POINT IS AT THE WORKING PRESSURE AND TEMPERATURE. INSTRUMENTS TO BE MANUFACTURED BY WEISS INSTRUMENT, MILJOCO CORPORATION OR APPROVED EQUAL.

i. PROVIDE THERMOMETERS IN PIPING AS INDICATED ON THE DRAWINGS AND AT THE INLET AND OUTLET OF EACH HYDRONIC COIL, HEAT EXCHANGER AND PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL TEMPERATURE. THERMOMETERS TO BE ORGANIC LIQUID FILLED.

ii. PROVIDE PRESSURE GAUGES IN PIPING AS INDICATED ON THE DRAWINGS AND AT SUCTION AND DISCHARGE OF EACH PUMP AND AT INLETS AND OUTLETS OF EACH HYDRONIC COIL, HEAT EXCHANGER AND PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL PRESSURE.

N. PIPE SUPPORTS:

i. PROVIDE ADEQUATE SUPPORT FOR PIPE AND CONTENTS TO PREVENT SAGGING, VIBRATION, OR SWAYING AND ALLOW FOR EXPANSION AND CONTRACTION. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE STRUCTURE CANNOT SUPPORT POINT LOADS.

ii. HORIZONTAL PIPING TO BE SUPPORTED BY FORGED STEEL ADJUSTABLE CLEVIS TYPE HANGER. MAXIMUM SPACING AS FOLLOWS:

a) STEEL 1 INCH AND SMALLER: 6 FEET.

b) STEEL 1-1/4 INCH AND LARGER: 10 FEET.

c) COPPER 1 INCH AND SMALLER: 5 FEET.

d) COPPER 1-1/2 IN to 2-1/2 INCH: 8 FEET.

e) COPPER 3 INCH: 10 FEET.

f) PROVIDE ADDITIONAL SUPPORTS AT CHANGES IN DIRECTION, BRANCH PIPING AND RUNOUTS OVER 5 FEET AND CONCENTRATE LOADS DUE TO VALVES, STRAINERS AND OTHER SIMILAR ITEMS.

iii. ROD SIZE

a) PIPE 2 IN AND SMALLER: 3/8 IN

b) PIPE 2-1/2 IN TO 3 IN: 1/2 IN

c) PIPE 4 TO 8 IN: 3/4 IN

iv. VERTICAL PIPING:

a) BASE ELBOW SUPPORT WITH BEARING PLATE ON STRUCTURAL SUPPORT.

b) GUIDES AT EVERY SECOND FLOOR (SPACING NOT TO EXCEED 25 FEET).

c) TOP SUPPORT HANGER OR SADDLE IN HORIZONTAL CONNECTION WITH PROVISIONS FOR EXPANSION.

d) INTERMEDIATE STEEL RISER CLAMP SUPPORT BOLTED AND WELDED TO PIPE BEARING ON STRUCTURAL STEEL OR BEARING PLATE AT FLOOR.

e) FOR MULTIPLE PIPES, COORDINATE GUIDES, BEARING PLATES AND ACCESSORY STEEL.

O. VALVES - GENERAL REQUIREMENTS

i. VALVE PRESSURE AND TEMPERATURE RATINGS: NOT LESS THAN INDICATED AND AS REQUIRED FOR SYSTEM PRESSURES AND TEMPERATURES.

ii. VALVE SIZES: SAME AS UPSTREAM PIPING UNLESS OTHERWISE INDICATED.

iii. VALVE-END CONNECTIONS:

a) FLANGED: WITH FLANGES ACCORDING TO ASME B16.1 FOR IRON VALVES

b) FLANGED: WITH FLANGES ACCORDING TO ASME B16.5 FOR STEEL VALVES

c) FLANGED: WITH FLANGES ACCORDING TO ASME B16.24 FOR BRONZE VALVES.

d) SOLDER JOINT: WITH SOCKETS ACCORDING TO ASME B16.18.

e) THREADED: WITH THREADS ACCORDING TO ASME B1.20.1.

f) VALVE BYPASS AND DRAIN CONNECTIONS: MSS SP-45.

iv. GENERAL-DUTY VALVE APPLICATIONS: UNLESS OTHERWISE INDICATED, USE THE FOLLOWING VALVE TYPES:

a) SHUTOFF SERVICE EXCEPT STEAM: BALL, BUTTERFLY OR GATE VALVES.

b) SHUTOFF SERVICE, STEAM: GATE VALVES.

c) THROTTLING SERVICE EXCEPT STEAM: BALL, BUTTERFLY, PLUG VALVES.

d) THROTTLING SERVICE, STEAM: GLOBE VALVES.

v. INSTALL SHUTOFF DUTY VALVES AT EACH BRANCH CONNECTION TO SUPPLY MAINS, AT SUPPLY CONNECTION TO EACH PIECE OF EQUIPMENT, UNLESS ONLY ONE PIECE OF EQUIPMENT IS CONNECTED IN THE BRANCH LINE. INSTALL THROTTLING DUTY VALVES AT EACH BRANCH CONNECTION TO RETURN MAINS, AT RETURN CONNECTIONS TO EACH PIECE OF EQUIPMENT, AND ELSEWHERE AS INDICATED.

vi. INSTALL CALIBRATED BALANCING VALVES IN THE RETURN WATER LINE OF EACH HEATING OR COOLING ELEMENT AND ELSEWHERE AS REQUIRED TO FACILITATE SYSTEM BALANCING.

vii. INSTALL SPRING LOADED CHECK VALVES AT EACH PUMP DISCHARGE AND ELSEWHERE AS REQUIRED TO CONTROL FLOW DIRECTION.

viii. THREADED CONNECTIONS ARE NOT TO BE USED FOR GLYCOL SYSTEMS.

18. LOW TEMPERATURE WATER SYSTEMS, BELOW 100 PSIG, -20 TO 200°F OPERATING TEMPERATURES

A. MATERIAL SHALL BE STEEL IN ACCORDANCE WITH ASTM A 53, SEAMLESS, GRADES A OR B.

i. WALL THICKNESS SHALL BE:

a) TO 2 INCH: SCHEDULE 40 WITH THREADED ENDS OR SCHEDULE 40 WITH SOCKET WELD ENDS.

b) 2-1/2 INCH TO 10 INCH: SCHEDULE 40, BUTT WELD ENDS ONLY.

c) 4 INCH AND SMALLER TYPE K, DRAWN-TEMPER COPPER TUBING, WROUGHT-COPPER FITTINGS, AND BRAZED JOINTS

d) NO THREADED JOINTS ARE ALLOWED IN GLYCOL SYSTEMS

B. IRON BUTTERFLY VALVES

i. 200 PSI COLD WORKING PRESSURE (CWP), 2 INCH TO 24 INCH, ASTM A126 CAST IRON BODY, ANSI 125/150 PATTERN, FULLY LUGGED, AND TAPPED BODY STYLE, CLOSED WATER SYSTEMS-ALUMINUM BRONZE DISC, OPEN WATER SYSTEMS-316 STAINLESS STEEL DISC, STAINLESS STEEL STEM, RESILIENT EPDM SEAT, BRONZE STEM BUSHING, STAINLESS STEEL DISC SCREWS OR TAPER PINS

MANUFACTURERS - IRON BUTTERFLY VALVES, KEYSTONE DIVISION OF TYCO FLOW CONTROL, BRAY VALVE & CONTROLS, ABZ VALVES & CONTROLS

C. BALL VALVES

i. 3 INCHES AND SMALLER- THREADED OR SOLDERED, 3 PIECE, CLASS 150 PSI STEAM, 600 PSI COLD WORKING PRESSURE (CWP), FULL PORT, ASTM B584 CAST BRONZE BODY, STAINLESS STEEL BALL AND STEM, CHROME PLATED BRASS BALL WITH BRASS STEM, BLOW OUT PROOF STEM DESIGN, PTFE SEATS, PTFE STEM PACKING, ZINC PLATED STEEL LEVER WITH VINYL COVERED GRIP, THREADED ENDS OR SOLDER ENDS AS REQUIRED BY PIPING SYSTEM.

ii. GLYCOL, 2 INCHES AND SMALLER- SOCKET WELDED - 3 PIECE, CLASS 150 PSI STEAM, 1000 PSI COLD WORKING PRESSURE (CWP), FULL PORT, 2 INCHES AND SMALLER, ASTM A108 CARBON STEEL BODY, STAINLESS STEEL BALL AND STEM, ASTM A108 CHROME PLATED BALL AND STEM, BLOW OUT PROOF STEM DESIGN, PTFE SEATS, PTFE STEM PACKING, ZINC PLATED STEEL LEVER WITH VINYL COVERED GRIP, SOCKET WELD ENDS

MANUFACTURERS - BRONZE BALL VALVES, CONBRACO INDUSTRIES INC.; APOLLO DIVISION, CRANE CO.; CRANE VALVE GROUP; JENKINS VALVES, STOCKHAM DIVISION, JAMESBURY INC., MILWAUKEE VALVE COMPANY

iii. GREATER THAN 3 INCH- FLANGE, ANSI FLANGED, CLASS 150 PSI STEAM, 285 PSI COLD WORKING PRESSURE (CWP), REDUCED PORT, 2½ INCHES TO 10 INCHES, ASTM A216 WCB CAST CARBON STEEL BODY , ASTM A216 WCB CHROME PLATED BALL, ASTM A108 CARBON STEEL STEM, BLOW OUT PROOF STEM DESIGN, PTFE SEATS, GRAPHITE STEM PACKING, GALVANIZED PIPE LEVER, RAISED FACE FLANGE ENDS.

MANUFACTURERS - STEEL BALL VALVES, CONBRACO INDUSTRIES INC.; APOLLO DIVISION, CRANE CO.; CRANE VALVE GROUP; STOCKHAM DIVISION, JAMESBURY INC., COOPER CAMERON CORP.; COOPER CAMERON VALVES DIV., MILWAUKEE VALVE COMPANY

D. SWING CHECK VALVES

i. 2 INCHES AND SMALLER, BRONZE SWING CHECK VALVES, MSS SP-80, CLASS 150

PSI STEAM, 300 PSI COLD WORKING PRESSURE (CWP), ASTM B 62 CAST - BRONZE BODY AND CAP, Y-PATTERN, STAINLESS STEEL FREE FLOATING HINGE PIN, THREADED CAP, REGRINDING SEAT, BRONZE DISC, THREADED (STEEL PIPING) END CONNECTION OR SOLDERED (COPPER PIPING) END CONNECTION AS REQUIRED BY PIPING SYSTEM.

MANUFACTURERS - BRONZE CHECK VALVES, HORIZONTAL AND VERTICAL, HORIZONTAL, CRANE CO.; CRANE VALVE GROUP; JENKINS VALVES, CRANE VALVES, STOCKHAM DIVISION, GRINNELL CORPORATION, WALWORTH COMPANY, NIBCO INC, VERTICAL, CINCINNATI VALVE CO

ii. 2½ INCH TO 12 INCH, ASME B16.10, IRON SWING CHECK VALVES, CLASS 125 PSI STEAM, 200 PSI COLD WORKING PRESSURE (CWP), CAST IRON BODY AND CAP, REPLACEABLE BRONZE SEAT RING, 6 INCH AND SMALLER: SOLID BRONZE DISC, 8 INCH AND LARGER: CAST IRON DISC WITH BRONZE FACING, REPLACEABLE BRASS HINGE PIN, FLANGED ENDS

MANUFACTURERS - IRON SWING CHECK VALVES, CRANE CO.; CRANE VALVE GROUP; JENKINS VALVES, STOCKHAM DIVISION, GRINNELL CORPORATION, CINCINNATI VALVE CO., NIBCO INC.

E. CALIBRATED BALANCING VALVES

i. 2 INCH AND SMALLER, 200 PSI COLD WORKING PRESSURE (CWP) UP TO 250°F, BRONZE BODY, STRAIGHT THROUGH BALL VALVE DESIGN, BRASS BALL, CARBON FILLED TFE SEAT RINGS, READ OUT PORTS WITH INTERNAL EPT INSERT AND CHECK VALVE, ¼ INCH NPT TAPPED DRAIN PORT, MEMORY STOP FEATURE, CALIBRATED NAMEPLATE, SWEAT ENDS

ii. 2 INCH AND SMALLER, 300 PSI COLD WORKING PRESSURE (CWP) UP TO 250°F, BRONZE BODY, STRAIGHT THROUGH BALL VALVE DESIGN, BRASS BALL, CARBON FILLED TFE SEAT RINGS, READ OUT PORTS WITH INTERNAL EPT INSERT AND CHECK VALVE, ¼ INCH NPT TAPPED DRAIN PORT, MEMORY STOP FEATURE, CALIBRATED NAMEPLATE, THREADED ENDS

iii. 2½ INCH TO 3 INCH,175 PSI COLD WORKING PRESSURE (CWP) UP TO 250°F, CAST IRON BODY, STRAIGHT THROUGH BALL VALVE DESIGN, BRASS BALL, CARBON FILLED TFE SEAT RINGS, READ OUT PORTS WITH INTERNAL EPT INSERT AND CHECK VALVE, MEMORY STOP FEATURE, CALIBRATED NAMEPLATE, ANSI CLASS 125 FLANGED END CONNECTIONS

iv. 3 INCH TO 12 INCH, 175 PSI COLD WORKING PRESSURE (CWP) UP TO 250°F, CAST IRON BODY, Y-PATTERN GLOBE VALVE DESIGN, BRONZE SEAT, REPLACEABLE BRONZE DISC, EPDM SEAL INSERT, STAINLESS STEEL STEM, READ OUT PORTS WITH INTERNAL EPT INSERT AND CHECK VALVE,MEMORY STOP FEATURE, CALIBRATED NAMEPLATE, ANSI CLASS 125 FLANGED END CONNECTIONS

v. MANUFACTURERS - ITT BELL & GOSETT, MACON, TUNSTALL CORP.

F. Y STRAINERS

i. SYSTEMS OF COPPER CONSTRUCTION, WORKING PRESSURE: TO 250 PSIG, NON-CHOCK. SIZES 1/4 INCH TO 2 INCH: CLASS 250. CONNECTIONS: THREADED. BODY: BRONZE, ASTM B62, WITH MACHINED SEAT FOR SCREEN RETENTION. CAP: BRONZE, ASTM B62, WITH MACHINED SEAT FOR SCREEN RETENTION. SCREEN: 20 MESH, 304 STAINLESS STEEL, ASTM 240. FREE AREA NOT LESS THAN 2-1/2 TIME INLET AREA. BLOWOFF OUTLET: WITH FEMALE NPT TAPPING, MUELLER MODEL NO. 352M.

ii. SYSTEMS OF COPPER CONSTRUCTION, WORKING PRESSURE TO 225 PSIG CLASS 150; TO 400 PSIG CLASS 300. SIZES 2-1/2 INCH TO 12 INCH: CONNECTIONS: FLANGED. BODY: BRONZE, ASTM B62 (85-5-5-5) OR BRONZE ASTM B61. ALUMINUM BRONZE ASTM A148-90 FOR SIZES 8 INCH AND LARGER. WITH MACHINED SEAT FOR SCREEN RETENTION. COVER: MATERIAL TO MATCH BODY. WITH MACHINED SEAT FOR SCREEN RETENTION. SCREEN TO 8 INCH: 1/8 INCH PERFORATIONS, 304 STAINLESS STEEL, ASTM 240. FREE AREA NOT LESS THAN 2-1/2 TIMES INLET AREA. SCREEN 10 INCH AND LARGER: 5/32 INCH PERFORATIONS, 304 STAINLESS STEEL, ASTM 240. FREE AREA NOT LESS THAN 2-1/2 TIMES INLET AREA. BLOWOFF OUTLET: WITH FEMALE NPT TAPPING., MUELLER MODEL NO. 851 OR 851M FOR CLASS 150, MUELLER MODEL. NO. 852 FOR CLASS 300.

G. PROVIDE 1/2 INCH DRAIN VALVE WITH CAPPED HOSE CONNECTION AT ALL LOW POINTS. PROVIDE 3/4 INCH GATE VALVE TO DRAIN SYSTEMS IN EQUIPMENT ROOMS.

H. PROVIDE MANUAL AIR VENTS LINE SIZE AIR CHAMBER WITH 1/2 INCH GLOBE VALVE AT ALL HIGH POINTS AND WHERE FLOW DIRECTION CHANGES FROM HORIZONTAL TO DOWNWARD.

I. PITCH WATER PIPING EXCEPT AS NOTED:

i. UP TO 1 INCH: 1 INCH IN 40 FEET.

ii. 1-1/2 INCH AND LARGER: 1 INCH IN 100 FEET.

J. CONDENSATE DRAIN PIPING

i. PIPE: ASTM B88, HARD DRAWN COPPER TUBING TYPE L.

ii. FITTINGS: SOLDERED JOINT FITTINGS, 95/5 SOLDER.

iii. PITCH: MINIMUM 1 INCH IN 8 FEET, PREFERRED 1 INCH IN 4 FEET

19. REFRIGERANT SYSTEMS

A. PROVIDE ALL REFRIGERANT PIPING REQUIRED FOR A COMPLETE REFRIGERATION SYSTEM, WITH ALL VALVES, FITTINGS AND SPECIALTIES NECESSARY FOR SATISFACTORY OPERATION IN ACCORDANCE WITH ASHRAE STANDARD 15-LATEST EDITION AND ALL AUTHORITIES HAVING JURISDICTION. REFRIGERATION SYSTEM SHALL INCLUDE ALL REQUIRED ITEMS FOR CHARGING, DRAINING AND PURGING THE SYSTEM.

B. REFRIGERANT PIPING SHALL BE HARD COOPER, TYPE L OR ACR, ASTM B88 OR ASTM B 280, BRAZED.

C. JOINTS IN REFRIGERATION PIPING SHALL BE BRAZED.

D. REFRIGERANT PIPING SHALL BE OF THE SIZE AND NUMBER OF PIPES RECOMMENDED BY THE MANUFACTURER AND AS APPROVED BY THE ENGINEER.

E. HORIZONTAL PIPING OF THE COMPRESSOR SUCTION AND DISCHARGE LINES AND THE CONDENSER DISCHARGE LINES SHALL BE PITCHED A MINIMUM OF ½ INCH IN 10 FEET, IN THE DIRECTION OF REFRIGERANT FLOW. EACH SUCTION GAS VERTICAL RISER SHALL BE TRAPPED AT ITS EVAPORATOR WITH A TRAP AS RECOMMENDED BY THE COMPRESSOR MANUFACTURER.

F. INSTALL REFRIGERANT PIPING TO PREVENT EXCESSIVE OIL FROM BEING TRAPPED IN THE SYSTEM. ANY ADDITIONAL RISERS OR EQUALIZER LINES REQUIRED BY THE MANUFACTURER OF EQUIPMENT FOR THE PROPER SYSTEM OPERATION SHALL BE INSTALLED AS PART OF THIS CONTRACT. PROVIDE A FULLY PIPED OIL SEPARATOR FOR EACH REFRIGERANT SYSTEM AS PER MANUFACTURER’S RECOMMENDATIONS.

G. VALVES SHALL BE DESIGNED FOR REFRIGERANT SERVICE. SHUTOFF VALVES SHALL BE BRASS PACKLESS TYPE. UNIONS, FLANGED VALVES OR FITTINGS SHALL BE PROVIDED FOR DISCONNECTING EQUIPMENT, CONTROLS, ETC. FOR MAKING REPAIRS. PIPING SHALL BE RUN IN A SINGLE LAYER, WITH EACH LINE ISOLATED FROM ANOTHER TO PREVENT RUBBING. PROVISION SHALL BE MADE FOR EXPANSION AND CONTRACTION OF PIPING. ALL PIPING PASSING THROUGH WALLS, PARTITIONS, ETC., SHALL BE FURNISHED WITH SLEEVES AS REQUIRED.

H. REFRIGERANT PIPING PASSING THROUGH RATED FLOORS OR DEMISING WALLS SHALL BE ENCLOSED IN A RIGID AND GAS-TIGHT CONTINUOUS FIRE-RESISTING PIPE DUCT OR SHAFT VENTED TO THE OUTSIDE, IN ACCORDANCE WITH ASHRAE STANDARD 15-LATEST EDITION. PIPE CONDUIT SHALL BE COPPER TUBE TYPE L WITH SOLDERED FITTINGS.

I. REFRIGERANT PIPING RUNNING THROUGH/ABOVE PUBLIC CORRIDORS SHALL BE INSTALLED WITHIN 1-HR RATED ENCLOSURE. UNLESS IT CONTAINS LESS THAN 10 POUNDS OF GROUP A-1 REFRIGERANT, ITS COMPLETE DISCHARGE INTO THE CORRIDOR WOULD BE LESS THAN 50% OF ITS RCL PER TABLE 1103.1 IN THE NYC AND IT IS INSTALLED AT LEAST 9' AFF.

J. SHAFTS CONTAINING REFRIGERANT PIPING SHALL NOT BE SHARED WITH ANY AIR DUCTWORK.

20. ELECTRICAL WORK

A. GENERAL:

i. ELECTRICAL POWER WIRING SHALL BE PROVIDED BY THE ELECTRICAL CONTRACT. CONTROL WIRING SHALL BE PROVIDED BY THE HVAC CONTRACT. CONTROL WIRING SHALL BE DEFINED AS ANY WIRING 120V AND BELOW INSTALLED FOR PURPOSES OTHER THAN PROVIDING PRIMARY ELECTRICAL POWER TO EQUIPMENT.

ii. MOTOR STARTERS AND VARIABLE FREQUENCY DRIVES (VFD) SHALL BE FURNISHED BY THE HVAC CONTRACTOR AND INSTALLED BY THE ELECTRICAL CONTRACTOR. REFER TO EQUIPMENT SECTION FOR VARIABLE FREQUENCY DRIVE SPECIFICATIONS.

iii. DUCT MOUNTED SMOKE DETECTORS, WHERE REQUIRED, SHALL BE PROVIDED BY AND WIRED BY THE ELECTRICAL CONTRACTOR, AND MOUNTED BY THE HVAC CONTRACTOR.

a) THIS CONTRACTOR SHALL INSTALL THE SMOKE DETECTOR SAMPLING TUBES IN THE DUCT AS COORDINATED IN THE FIELD.

b) THIS CONTRACTOR SHALL ASSIST THE ELECTRICAL CONTRACTOR IN TESTING THE DUCT-MOUNTED SMOKE DETECTION SYSTEM.

iv. ALL ELECTRICAL CONTROL WIRING SHALL COMPLY WITH LOCAL ELECTRICAL CODE, ALL AUTHORITIES HAVING JURISDICTION AND THE PROJECT ELECTRICAL SPECIFICATIONS.

v. MECHANICAL CONTRACTOR TO OBTAIN QUANTITY OF CONTROLLERS REQUIRED AND COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL OPERATING REQUIREMENTS, INTERLOCKS AND CONNECTIONS FOR STARTERS.

vi. THE MECHANICAL CONTRACTOR SHALL PREPARE AND SUBMIT FOR APPROVAL POINT TO POINT, COMPLETELY COORDINATED WIRING DIAGRAMS AND INDICATE ALL SOURCE POWER REQUIREMENTS AND ALL FIELD WIRING TO BE PERFORMED BY THE ELECTRICAL CONTRACTOR.

vii. WHERE EXISTING STARTERS ARE TO BE REUSED, THIS CONTRACTOR SHALL MAINTAIN ALL EXISTING CONTROL CONNECTIONS. WHERE NEW STARTERS ARE TO BE PROVIDED TO REPLACE EXISTING, THIS CONTRACTOR SHALL SURVEY THE EXISTING CONTROL CONNECTIONS AND PREPARE AN EXISTING CONTROL WIRING DIAGRAM PRIOR TO DEMOLITION FOR SUBMITTAL TO THE ENGINEER. THE NEW STARTERS SHALL BE PROVIDED WITH THE NECESSARY CONTACTS AND RELAYS REQUIRED TO RECONNECT THE EXISTING CONTROLS. PROVIDE ALL REQUIRED CONTACTS FOR START/STOP AND FIRE ALARM.

21. MOTORS:

A. MOTORS SHALL HAVE THE ELECTRICAL CHARACTERISTICS AS LISTED ON THE DRAWINGS. COORDINATE ALL REQUIREMENTS WITH ELECTRICAL CONTRACTOR. ALL MOTORS SHALL COMPLY WITH NEMA MG-1 STANDARD AND SHALL BE OF THE HIGH EFFICIENCY TYPE AND MEET THE 1992 EPA ENERGY EFFICIENCY ACT AND UTILITY COMPANY REBATE REQUIREMENTS.

B. MOTORS FOR VARIABLE FREQUENCY DRIVES (VFD) SHALL BE SUITABLE FOR USE WITH VARIABLE FREQUENCY DRIVES AND COMPLY WITH NEMA MG-1 PART 31.40.4.2. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL REQUIREMENTS OF THE MOTOR AND VFD MANUFACTURER.

C. IF CONTRACTOR ELECTS TO SUBSTITUTE OR INCREASE MOTOR HORSEPOWER OVER THAT SPECIFIED, THE COST OF MOTOR AND ELECTRICAL CHANGES SHALL BE BORNE BY THIS CONTRACTOR.

D. MOTORS (UNDER HVAC WORK): IN ACCORDANCE WITH NEMA, IEEE AND ANSI C50 STANDARDS:

i. STANDARD EFFICIENCY UNLESS OTHERWISE NOTED.

ii. 1.15 SERVICE FACTOR INCLUDING MOTORS SERVED FROM A VFD

iii. SQUIRREL CAGE INDUCTION, OPEN DRIPPROOF TYPE, 1750 RPM, NEMA TYPE B INSULATION CLASS, CONTINUOUS DUTY, EXCEPT AS NOTED.

22. MOTOR CONTROLLERS

A. SUPPLIED BY HVAC CONTRACTOR AND INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR.

B. ENCLOSURES:

i. PROVIDE ENCLOSURES FOR STARTERS AND VFD'S SUITABLE FOR OPERATING ENVIRONMENT. ENCLOSURE'S SHALL BE NEMA 1 VENTILATED SHEETMETAL FOR INDOOR APPLICATION, NEMA 3R WITH ADDITIONAL GASKETING WEATHER-PROOF RAINTIGHT ENCLOSURE FOR EXPOSED OUTDOOR SERVICE OR INDOOR SERVICE EXPOSED TO MOISTURE. PROVIDE DISCONNECT SWITCH ON ENCLOSURE AS REQUIRED FOR SERVICE.

C. WITH SOLID-STATE (ELECTRONIC) OVERLOAD PROTECTION. COORDINATE ALL MOTOR CONTROLLER TYPES AND SIZES WITH MOTOR TYPES AND SIZES.

D. 1/3 HP AND SMALLER: PROVIDE MANUAL STARTER EXCEPT USE MAGNETIC TYPE WHERE AUTOMATICALLY CONTROLLED.

i. MANUAL TYPE: 2-POLE TOGGLE SWITCH WITH OVERLOAD PROTECTION AND PILOT LIGHT.

E. 1/2 HP AND LARGER: PROVIDE MAGNETIC STARTER:

i. COMBINATION UNFUSED DISCONNECT SWITCH AND MAGNETIC STARTER EXCEPT AS NOTED.

ii. SOLID-STATE (ELECTRONIC) OVERLOAD PROTECTION IN EACH PHASE LEG WITH RESET IN ENCLOSURE.

iii. HOA SELECTOR SWITCH FOR AUTOMATICALLY OPERATED MOTORS. SAFETY CONTROLS COMMON TO BOTH CONTROLS.

iv. RED, GREEN AND AMBER PILOT LIGHTS.

v. SWITCHES: HORSE-POWER-RATED, EXTERNAL PADLOCKING TYPE.

vi. HOLDING COILS: 10 WATT, 120 VOLT.

vii. CONTACTS: MAIN LINE AND MINIMUM (2) - NORMALLY OPEN, (2) - NORMALLY CLOSED 10 AMP AUXILIARIES, IN ADDITION TO CONTACTS

viii. REQUIRED FOR CONTROLS SPECIFIED.

ix. CONTROL TRANSFORMER: FOR MOTORS OVER 120 VOLTS, TO STEP DOWN CONTROL VOLTAGE TO 120 VOLTS; OF THE REQUIRED CAPACITY WITH FUSE AND GROUND CONNECTION ON VOLTAGE SIDE.

x. FUSES: SIMILAR TO BUSSMAN.

xi. RELAYS: TO SUPPLEMENT AUXILIARY CONTACTS IN CONTROLLER. MINIMUM 10 WATT COIL AND TWO 10 AMP CONTACTS.

xii. TERMINALS: SUITABLE FOR CONDUCTORS NOTED AND AS APPROVED.

F. DISCONNECT SWITCHES ARE PROVIDED BY THE ELECTRICAL CONTRACTOR IF NOT INTEGRAL WITH EQUIPMENT.

G. ACCEPTABLE MANUFACTURERS:

i. EATON/ CUTLER HAMMER.

ii. SQUARE D.

iii. ALLEN BRADLEY.

iv. ABB

23. EQUIPMENT

A. PROVIDE ALL EQUIPMENT AND ACCESSORIES OF THE SIZES AND CAPACITIES AS SCHEDULED AND AS INDICATED ON THE DRAWINGS.

B. INSTALL EQUIPMENT IN ACCORDANCE WITH APPROVED SHOP DRAWINGS, MANUFACTURERS INSTRUCTIONS AND ALL CODES AND REGULATIONS WHICH APPLY.

C. PROVIDE EQUIPMENT SUPPORTS AND/OR MOUNTINGS AS INDICATED ON THE DRAWING, IN VIBRATION SPECIFICATION AND AS FOLLOWS:

i. FLOOR MOUNTED EQUIPMENT - PROVIDE DIMENSIONS FOR A 4 INCH CONCRETE HOUSEKEEPING PAD WITH ALL REQUIRED WATERPROOFING TO THE CONSTRUCTION MANAGER.

ii. EQUIPMENT ON FLOOR STANDS - PROVIDE FLOOR STAND OF STRUCTURAL STEEL OR STEEL PIPES AND FITTINGS ATTACHED TO FLOOR.

iii. ROOF MOUNTED EQUIPMENT - PROVIDE PREFABRICATED ISOLATED ROOF CURB WITH INTEGRAL VIBRATION ISOLATORS.

iv. CEILING MOUNTED EQUIPMENT - PROVIDE SUPPORTS WITH APPROVED SUITABLE ANCHORS SUSPENDED DIRECTLY FROM BUILDING STEEL STRUCTURE.

v. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED TO ADEQUATELY SUPPORT THE EQUIPMENT LOAD.

vi. EQUIPMENT SHALL BE INSTALLED WITH VIBRATION ISOLATION, REFER TO VIBRATION ISOLATION SECTION.

D. RIGGING

i. THIS CONTRACTOR SHALL SURVEY THE BUILDING AND VERIFY THE RIG PATH PRIOR TO PURCHASE OF EQUIPMENT. CONFIRM ALL EQUIPMENT FITS THROUGH ALL HALLWAYS, DOORS, ELEVATORS, WINDOWS, ETC. WITHOUT REQUIRING MAJOR ALTERATIONS TO THE EXISTING BUILDING CONDITIONS. ANY MODIFICATIONS TO EXISTING CONDITIONS SHALL BE REPAIRED OR REPLACED BY CONTRACTOR.

ii. THIS CONTRACTOR SHALL PROVIDE ALL REQUIRED RIGGING, HOISTING AND BRACING TO INSTALL THE EQUIPMENT AS INDICATED ON THE PLANS. THIS WORK SHALL BE PERFORMED BY AN INSURED CERTIFIED LICENSED RIGGING COMPANY THAT IS EXPERIENCED IN RIGGING EQUIPMENT OF THE TYPE INDICATED FOR THE AREAS SHOWN ON THE CONSTRUCTION DOCUMENTS. THIS CONTRACTOR SHALL SUBMIT RIGGING PLANS FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK.

iii. ALL PERMITS REQUIRED FROM THE AUTHORITIES AND AGENCIES INVOLVED TO PERFORM THE RIGGING ARE THE RESPONSIBILITIES OF THIS CONTRACTOR.

iv. ALL STRUCTURAL SUPPORTS, MODIFICATIONS OR ADDITIONS ARE TO BE SUBMITTED TO THE STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK. ALL SUPPLEMENTAL STRUCTURAL SUPPORTS, ELEVATOR CHARGES /MODIFICATIONS, BRACING AND PROTECTION REQUIRED FOR THE RIG IS THE RESPONSIBILITY OF THIS CONTRACTOR.

v. THE RIGGING CONTRACTOR SHALL HIRE AND PAY FOR ALL CHARGES AND SERVICES OF THE BUILDING ELEVATOR CONTRACTOR FOR THE RIGGING OF THE EQUIPMENT.

E. UP FRONT PURCHASE OF EQUIPMENT

i. THE CONTRACTOR SHALL SUBMIT A LIST OF LONG LEAD TIME ITEMS THAT WILL AFFECT THE SCHEDULE OF THE PROJECT IF NOT PURCHASED IMMEDIATELY UP FRONT AT THE START OF THE PROJECT. THE MECHANICAL CONTRACTOR SHALL SUBMIT PROPOSED MANUFACTURER AND LEAD TIMES FOR ALL PROJECT EQUIPMENT AT TIME OF PROJECT AWARD.

24. AUTOMATIC CONTROLS - GENERAL REQUIREMENTS

A. WORK INCLUDED

i. FURNISH AND INSTALL AS HEREIN SPECIFIED, A COMPLETE AUTOMATIC TEMPERATURE CONTROL SYSTEM. MANUFACTURER SHALL BE SUBMITTED WITH BID AND APPROVED BY ENGINEER BEFORE BID AWARD. THE ATC CONTRACTOR SHALL BE AN INDEPENDENT CONTRACTOR NOT AFFILIATED WITH THE MECHANICAL CONTRACTOR.

ii. PROVIDE POWER FOR PANELS AND CONTROL DEVICES FROM A SOURCE DESIGNATED BY THE ELECTRICAL CONTRACTOR.

iii. COORDINATE INSTALLATION SCHEDULE WITH THE MECHANICAL CONTRACTOR AND GENERAL CONTRACTOR.

iv. FURNISH, MOUNT, AND WIRE ALL ASSOCIATED PANELS AND DEVICES FOR THE SYSTEM TO BE COMPLETELY OPERATIONAL REGARDLESS OF FUNCTION OR VOLTAGE, UNLESS OTHERWISE STATED.

B. SUBMITTALS

i. PRODUCT DATA: INCLUDE MANUFACTURER'S TECHNICAL LITERATURE FOR EACH CONTROL DEVICE INDICATED, LABELED WITH SETTING OR ADJUSTABLE RANGE OF CONTROL. INDICATE DIMENSIONS, CAPACITIES, PERFORMANCE CHARACTERISTICS, ELECTRICAL CHARACTERISTICS, FINISHES FOR MATERIALS, AND INSTALLATION AND STARTUP INSTRUCTIONS FOR EACH TYPE OF PRODUCT INDICATED.

ii. 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.

a) SCHEMATIC FLOW DIAGRAMS SHOWING FANS, COILS, DAMPERS, VALVES, AND CONTROL DEVICES.

b) WIRING DIAGRAMS: POWER, SIGNAL, AND CONTROL WIRING.

c) DETAILS OF CONTROL PANEL FACES, INCLUDING CONTROLS, INSTRUMENTS, AND LABELING.

C. QUALITY ASSURANCE

i. INSTALLER QUALIFICATIONS: A QUALIFIED INSTALLER WHO IS AN AUTHORIZED REPRESENTATIVE OF THE AUTOMATIC CONTROL SYSTEM MANUFACTURER FOR BOTH INSTALLATION AND MAINTENANCE OF UNITS REQUIRED FOR THIS PROJECT.

ii. COMPLY WITH ALL CURRENT GOVERNING CODES, ORDINANCES, AND REGULATIONS INCLUDING UL, NFPA, THE LOCAL BUILDING CODE, NEC, ETC.

iii. MATERIALS AND EQUIPMENT SHALL BE THE CATALOGUED PRODUCTS OF MANUFACTURERS REGULARLY ENGAGED IN PRODUCTION AND INSTALLATION OF AUTOMATIC TEMPERATURE CONTROL SYSTEMS AND SHALL BE MANUFACTURER'S LATEST STANDARD DESIGN THAT COMPLIES WITH THE SPECIFICATION REQUIREMENTS.

25. SEQUENCE OF OPERATIONS:

A. HEAT PUMP SEQUENCE:

1) PROVIDE A PROGRAMMABLE THERMOSTAT (BY MANUFACTURER) FOR EACH AIR HANDLER, WITH CAPABILITY FOR FAN TO BE ALWAYS ON OR IN AUTOMATIC MODE.

a) PROGRAMMABLE THERMOSTAT SHALL BE CAPABLE OF SETBACK CONTROLS, PROGRAMMED BY THE END USER, FOR 65°F AND 80°F IN WINTER AND SUMMER, RESPECTIVELY.

b) PROGRAMMABLE THERMOSTAT SHALL HAVE 5°F DEADBAND AND SETPOINT OVERLAP RESTRICTIONS

c) ALL UNITS TO BE CONNECTED TO CENTRALIZED CONTROLLER FOR MONITORING AND CONTROL.

2) PROVIDE ALL WIRING FROM CONDENSING UNITS TO RESPECTIVE AIR HANDLERS AND CENTRAL CONTROLLER.

3) FAN MODES:

IN ON MODE, FAN SHALL RUN CONTINUOUSLY. WHEN THE FAN STOPS, EACH ASSOCIATED MOTORIZED DAMPER SHALL CLOSE.

IN AUTOMATIC MODE, FAN SHALL ONLY ENERGIZE UPON A CALL FOR COOLING/HEATING.

4) UNIT MODES:

a) IN COOLING MODE, THE CONDENSER SHALL CYCLE (ON, OFF) TO MAINTAIN SETPOINT.

b) IN HEATING MODE, THE HEAT PUMP SHALL CYCLE (ON, OFF) TO MAINTAIN SETPOINT.

c) FOR UNITS SERVING SPACES WITH EXTERIOR DOORS: DOOR SWITCH SHALL TEMPORARILY SHUT DOWN RESPECTIVE AHU WHEN DOOR IS OPEN FOR MORE THAN 5 MINUTES. UPON DOOR CLOSING, SYSTEM SHALL RE-ENERGIZE.

d) FOR AHUS SERVING AMENITY SPACES, ASSOCIATED THERMOSTATS SHALL DEFAULT TO SETBACK TEMPERATURES DURING UNOCCUPIED HOURS.

B. BOILER:

I. START UP

a) UPON A COMMAND TO START THE BOILER, THE BOILER SHALL ENERGIZE, THE FRESH AIR AND FLUE DAMPERS SHALL OPEN.

II. WARM UP MODE

a) WARM UP MODE SHALL BE INITIATED BY A TIME OF DAY SCHEDULE AS REQUIRED BY THE OWNER.

b) BOILER PUMPS SHALL ACTIVATE AND RUN CONTINOUSLY.

c) THE BOILER BURNER SHALL ACTIVATE AND SHALL REMAIN ON UNTIL THE SPACE TEMPERATURE (AS SENSED BY THE THERMOSTAT) HAS BEEN SATISFIED. THE SETPOINT SHALL BE 72°F (adj.)

III. ACTIVE MODE

a) THE BOILER PUMP SHALL START AND REMAIN ON.

b) THE BOILER'S BURNERS SHALL MODULATE TO MAINTAIN A HOT WATER SUPPLY SETPOINT. SETPOINT SHALL BE DETERMINED BY THERMOSTAT

INPUT. THE HOT WATER SUPPLY SETPOINT SHALL VARY LINEARLY ACCORDING TO MANUFACTURERS RECOMMENDATIONS.

Essex County Farmworker Housing Renovation

MECHANICAL SPECIFICATIONS: STABLES

1. GENERAL

A. THE "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION," AIA DOCUMENT A201, LATEST EDITION, AND THESE SPECIFICATIONS AS APPLICABLE ARE PART OF THIS CONTRACT.

B. CONTRACTOR SHALL BE NEW YORK STATE CLEAN HEAT CERTIFIED IN ORDER TO OBTAIN ENERGY CONSERVATION / ELECTRIFICATION REBATES FOR THE PROPOSED WORK.

C. ALL APPLICABLE CODES, LAWS AND REGULATIONS GOVERNING OR RELATING TO ANY PORTION OF THIS WORK ARE HEREBY INCORPORATED INTO AND MADE A PART OF THESE SPECIFICATIONS, AND THEIR PROVISIONS SHALL BE CARRIED OUT BY THE CONTRACTOR WHO SHALL INFORM THE OWNER, PRIOR TO SUBMITTING A PROPOSAL, OF ANY WORK OR MATERIALS WHICH VIOLATE ANY OF THE ABOVE LAWS AND REGULATIONS. ANY WORK DONE BY THE CONTRACTOR CAUSING SUCH VIOLATION SHALL BE CORRECTED BY THE CONTRACTOR.

D. INVESTIGATE EACH SPACE THROUGH WITCH EQUIPMENT MUST BE MOVED INCLUDING HALLWAYS, DOOR WIDTHS, ELEVATOR DIMENSIONS, ETC. WHERE NECESSARY, EQUIPMENT SHALL BE SHIPPED FROM MANUFACTURER IN SECTIONS OF SIZE SUITABLE FOR MOVING THROUGH AVAILABLE RESTRICTIVE SPACES. ASCERTAIN FROM BUILDING OWNER AT WHAT TIMES OF DAY EQUIPMENT MAY BE MOVED THROUGH ALL AREAS.

E. DUCTWORK AND PIPING IS SHOWN DIAGRAMMATICALLY AND DOES NOT SHOW ALL OFFSETS, DROPS AND RISES OF RUNS. THE CONTRACTOR SHALL ALLOW IN HIS PRICE FOR ROUTING OF DUCTWORK AND PIPING TO AVOID OBSTRUCTIONS. EXACT LOCATIONS ARE SUBJECT TO APPROVAL OF ARCHITECT. COORDINATION WITH THE EXISTING SERVICES, INCLUDING THOSE OF OTHER TRADES IS REQUIRED.

F. SUPPORT ALL DUCTWORK AND PIPING FROM BUILDING STRUCTURE AND/OR FRAMING IN AN APPROVED MANNER. WHERE OVERHEAD CONSTRUCTION DOES NOT PERMIT FASTENING OR SUPPORTS FOR EQUIPMENT, FURNISH ADDITIONAL FRAMING. INSERTS SHALL BE STEEL, SLOTTED TYPE AND FACTORY PAINTED. SINGLE ROD SHALL BE SIMILAR TO GRINNELL FIG. 281. MULTI-ROD SHALL BE SIMILAR TO FEE & MASON SERIES 9000 WITH END CAPS AND CLOSURE STRIPS. MAXIMUM LOADING INCLUDING PIPES, DUCTWORK CONTENTS AND COVERING SHALL NOT EXCEED 75% OF RATED INSERT CAPABILITY. WHEN SUPPORTING FROM BUILDING USE BEAM CLAMPS IN APPROVED MANNER.

G. INSTALL WORK SO AS TO BE READILY ACCESSIBLE FOR OPERATION, MAINTENANCE AND REPAIR. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ACCOMPLISH THIS, BUT CHANGES WHICH INVOLVE EXTRA COST SHALL NOT BE MADE WITHOUT APPROVAL.

H. REMOVAL AND RELOCATION OF CERTAIN EXISTING WORK WILL BE NECESSARY FOR THE PERFORMANCE OF THE GENERAL WORK. ALL EXISTING CONDITIONS CANNOT BE COMPLETELY DETAILED ON THE DRAWINGS. THE CONTRACTOR SHALL SURVEY THE SITE AND INCLUDE ALL CHANGES IN MAKING UP THE WORK PROPOSAL.

I. PLAN INSTALLATION OF NEW WORK AND CONNECTIONS TO EXISTING WORK TO ENSURE MINIMUM INTERFERENCE WITH REGULAR OPERATION OF EXISTING FACILITIES. ALL SYSTEM SHUTDOWNS AFFECTING OTHER AREAS SHALL BE COORDINATED WITH BUILDING OWNER. INSTALL ISOLATION VALVES AT POINT OF CONNECTION TO THE EXISTING PIPING. PROVIDE TEMPORARY DUCT CAPS AND/OR CONNECTIONS TO MINIMIZE SHUTDOWN TIME.

J. CONNECT NEW WORK TO EXISTING WORK IN NEAT AND APPROVED MANNER. RESTORE EXISTING WORK DISTURBED WHILE INSTALLING NEW WORK TO ACCEPTABLE CONDITION AS DETERMINED BY ARCHITECT.

K. DISCONNECT, REMOVE AND/OR RELOCATE EXISTING MATERIAL, EQUIPMENT AND OTHER WORK AS NOTED OR REQUIRED FOR PROPER INSTALLATION OF NEW SYSTEM.

L. THE CONTRACTOR SHALL KEEP ALL EQUIPMENT AND MATERIALS, AND ALL PARTS OF THE BUILDING, EXTERIOR SPACES AND ADJACENT STREETS, SIDEWALKS AND PAVEMENTS, FREE FROM MATERIAL AND DEBRIS RESULTING FROM THE EXECUTION OF THIS WORK. EXCESS MATERIALS WILL NOT BE PERMITTED TO ACCUMULATE EITHER ON THE INTERIOR OR THE EXTERIOR.

M. SEAL OPENINGS AROUND DUCTS AND PIPING THROUGH PARTITIONS, WALLS AND FLOORS (NOT IN SHAFTS) WITH MINERAL WOOL OR OTHER NONCOMBUSTIBLE MATERIAL.

N. PROVIDE ALL NECESSARY FLASHING AND COUNTERFLASHING TO MAINTAIN THE WATERPROOFING INTEGRITY OF THIS BUILDING AS REQUIRED BY THE INSTALLATION OR REMOVAL OF PIPES, DUCTS, LOUVERS, CONDUIT, AND EQUIPMENT. PROVIDE EQUIPMENT CURBS AND DUNNAGE STEEL AS REQUIRED.

O. ALL PRESENT MATERIAL, EQUIPMENT AND CONSTRUCTION DEBRIS TO BE REMOVED UNDER THIS CONTRACT, WITH THE EXCEPTION OF SPECIFIC EQUIPMENT AND APPARATUS REQUESTED BY THE BUILDING REPRESENTATIVE, ARCHITECT OR AS NOTED TO BE RELOCATED ON THE DRAWINGS, SHALL BE PROPERLY DISPOSED OF BY THIS CONTRACTOR.

P. MATERIALS AND WORKMANSHIP, UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

Q. THE WORK IN THE BUILDING SHALL BE DONE WHEN AND AS DIRECTED, AND IN A MANNER SATISFACTORY TO THE OWNER. THE WORK SHALL BE PERFORMED SO AS TO CAUSE THE LEAST POSSIBLE INCONVENIENCE AND DISTURBANCE TO THE PRESENT OCCUPANTS.

R. THE CONTRACTOR'S PROPOSAL FOR ALL WORK SHALL BE PREDICATED ON THE PERFORMANCE OF THE WORK DURING REGULAR WORKING HOURS. WHEN SO DIRECTED, HOWEVER, THE CONTRACTOR SHALL INSTALL WORK IN OVERTIME AND THE ADDITIONAL COST TO BE CHARGED THEREFORE SHALL BE ONLY THE PREMIUM PORTION OF THE WAGES PAID.

S. UNLESS OTHERWISE SPECIFIED, INCLUDE ALL CUTTING AND PATCHING OF EXISTING FLOORS, WALLS, PARTITIONS AND OTHER MATERIALS IN THE EXISTING BUILDING. THE CONTRACTOR SHALL RESTORE THESE AREAS TO ORIGINAL CONDITION.

T. ALL MATERIAL AND EQUIPMENT TO BE NEW UNLESS OTHERWISE NOTED AND SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

U. SUBMISSION OF A PROPOSAL SHALL BE CONSTRUED AS EVIDENCE THAT A CAREFUL EXAMINATION OF THE PORTIONS OF THE EXISTING BUILDING, EQUIPMENT, ETC. WHICH AFFECT THIS WORK, AND THE ACCESS TO SUCH SPACES, HAS BEEN MADE AND THAT THE CONTRACTOR IS FAMILIAR WITH EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT THE EXECUTION OF THE WORK. LATER CLAIMS SHALL NOT BE MADE FOR LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WHICH COULD HAVE BEEN FORESEEN DURING SUCH AN EXAMINATION. THE ON-SITE INSPECTION SHALL VERIFY EXISTING DUCTWORK, PIPING (SIZES, CLEARANCES, ETC.) AND CONDITIONS.

V. INSURANCE: IN ACCORDANCE WITH BUILDING REQUIREMENTS AND SHALL INCLUDE A HOLD HARMLESS CLAUSE FOR OWNER AND ENGINEER.

W. THE FINAL ACCEPTANCE WILL BE MADE AFTER THE CONTRACTOR HAS ADJUSTED HIS EQUIPMENT, BALANCED THE VARIOUS SYSTEMS, DEMONSTRATED THAT IT FULFILLS THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS AND HAS FURNISHED ALL THE REQUIRED CERTIFICATES OF INSPECTION AND APPROVAL.

X. GUARANTEE:

i. ALL MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THIS WORK. FINAL ACCEPTANCE SHALL BE DEFINED AS THE TIME AT WHICH THE MECHANICAL WORK IS TAKEN OVER AND ACCEPTED BY THE OWNER, AND IS UNDER CARE, CUSTODY, AND CONTROL OF THE OWNER. ENGAGE THE SERVICES OF VARIOUS MANUFACTURERS SUPPLYING THE EQUIPMENT FOR THE PROPER STARTUP AND OPERATION OF ALL SYSTEMS INSTALLED. INSTRUCT THE OWNERS PERSONNEL IN THE PROPER OPERATION AND SERVICING OF THE SYSTEM.

ii. THE CONTRACTOR SHALL GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY W0RKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN THE GUARANTEE PERIOD. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL INCLUDE RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS,

REPAIRS OR REPLACEMENTS IN EQUIPMENT SUPPLIED BY THIS CONTRACTOR.

iii. THIS CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE AND OPERATION OF ALL SYSTEMS UNTIL THE FINAL ACCEPTANCE OF THE WORK.

iv. ALL AIR CONDITIONING UNIT COMPRESSORS AND REFRIGERATION COMPONENTS SHALL HAVE A 5-YEAR WARRANTY.

Y. SPECIFICATIONS ARE OF SIMPLIFIED FORM AND INCLUDE INCOMPLETE SENTENCES. WORDS OR PHRASES SUCH AS "THE CONTRACTOR SHALL," "SHALL BE," "FURNISH," "PROVIDE," "A," "THE," AND "ALL" HAVE BEEN OMITTED FOR BREVITY.

Z. DEFINITIONS:

i. "PROVIDE": TO SUPPLY, INSTALL AND CONNECT UP COMPLETE AND READY FOR SAFE AND REGULAR OPERATION THE PARTICULAR WORK REFERRED TO UNLESS SPECIFICALLY OTHERWISE NOTED.

ii. "INSTALL": TO ERECT, MOUNT AND CONNECT COMPLETE WITH RELATED ACCESSORIES.

iii. "FURNISH" OR "SUPPLY": TO PURCHASE, PROCURE, ACQUIRE AND DELIVER COMPLETE WITH RELATED ACCESSORIES.

iv. "WORK": LABOR, MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES AND OTHER ITEMS REQUIRED FOR PROPER AND COMPLETE INSTALLATION.

v. "CONCEALED": EMBEDDED IN MASONRY OR OTHER CONSTRUCTION, INSTALLED IN FURRED SPACES, WITHIN DOUBLE PARTITIONS OR HUNG CEILINGS, IN TRENCHES, IN CRAWL SPACES, OR IN ENCLOSURES.

vi. "EXPOSED": NOT INSTALLED UNDERGROUND OR "CONCEALED" AS DEFINED ABOVE.

vii. "SIMILAR" OR "EQUAL": EQUAL IN MATERIALS, WEIGHT, SIZE, DESIGN AND EFFICIENCY OF SPECIFIED PRODUCT.

2. SCOPE OF WORK

A. THE WORK UNDER CONTRACT INCLUDES ALL LABOR, MATERIALS AND APPLIANCES NECESSARY FOR THE FURNISHING, INSTALLING AND TESTING, COMPLETE AND READY FOR SAFE OPERATION OF THE SYSTEMS. WORK SHALL BE INSTALLED IN A NEAT, WORKMANLIKE MANNER.

B. THE CONTRACTOR SHALL GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH THE DEPARTMENT HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT THIS WORK AND PAY ALL FEES THEREFORE. THE

CONTRACTOR SHALL ARRANGE FOR INSPECTION AND TESTS OF ANY OR ALL PARTS OF THE WORK IF SO REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. THE CONTRACTOR SHALL PAY ALL COSTS FOR, AND FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO THIS WORK.

C. THE CONTRACTOR SHALL FURNISH A WRITTEN GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY WORKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN ONE YEAR FROM THE DATE OF FINAL CERTIFICATE FOR PAYMENT AND/OR FROM DATE OR ACTUAL USE OF EQUIPMENT OR OCCUPANCY OF SPACES, BY OWNER, INCLUDED UNDER THE VARIOUS PARTS OF THE WORK, WHICHEVER DATE IS EARLIER. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL ALSO PROVIDE THAT WHERE DEFECTS OCCUR, THE CONTRACTOR WILL ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS, REPAIRS OR REPLACEMENTS IN EQUIPMENT SUPPLIED BY THE CONTRACTOR.

D. PERMITS AND FEES

i. THE CONTRACTOR SHALL GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH THE DEPARTMENT HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT THIS WORK AND PAY ALL FEES THEREFORE. THE CONTRACTOR SHALL ARRANGE FOR INSPECTION AND TEST OF ANY OR ALL PARTS OF THE WORK IF SO REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. THE CONTRACTOR SHALL PAY ALL COSTS FOR, FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO THIS WORK.

ii. THIS CONTRACTOR SHALL PREPARE OR HIRE THE NECESSARY CONSULTANTS TO PREPARE AND FILE ALL PLANS, CALCULATION, FORMS, ETC. REQUIRED FOR FILING WITH ALL AGENCIES REQUIRED FOR THIS WORK INCLUDING BUT NOT LIMITED TO THE DEP (DEPARTMENT OF ENVIRONMENTAL PROTECTION), DEC (DEPARTMENT OF ENVIRONMENTAL CONSERVATION), BUREAU OF AIR RESOURCES, EPA (ENVIRONMENTAL PROTECTION AGENCY), FDNY, ETC.

E. INSPECTIONS & TESTING / SPECIAL INSPECTIONS

i. THIRD PARTY INSPECTION AGENCY SHALL BE HIRED BY THE OWNER TO PERFORM ALL INSPECTIONS REQUIRED BY ALL LOCAL CODES.

F. PRIOR TO THE INSTALLATION OF ANY WORK AND PROCUREMENT OF EQUIPMENT PROVIDE COMPLETE SET OF COORDINATED SHOP DRAWINGS OF ALL NEW AND EXISTING EQUIPMENT, DUCTWORK, PIPING AND CONTROL SYSTEMS INDICATING CAPACITY DIMENSIONS AND SEQUENCE OF OPERATION FOR WRITTEN APPROVAL BY THE ARCHITECT AND ENGINEER.

G. WITHIN 15 DAYS AFTER AWARD OF CONTRACT, SUBMIT FOR REVIEW, A LIST OF ALL MATERIAL AND EQUIPMENT MANUFACTURER'S PRODUCTS THAT ARE PROPOSED, AS WELL AS NAMES OF ALL SUBCONTRACTORS WHOM THIS TRADE PROPOSES TO UTILIZE ON THIS PROJECT.

3. SHOP DRAWINGS

A. INDICATE ON EACH SUBMISSION: PROJECT NAME AND LOCATION, ARCHITECT AND ENGINEER, ITEM IDENTIFICATION AND APPROVAL STAMP OF PRIME CONTRACTOR, SUBCONTRACTOR NAMES AND PHONE NUMBERS, REFERENCE TO THE APPLICABLE DESIGN DRAWING OR SPECIFICATION ARTICLE, DATE AND SCALE.

B. THE WORK DESCRIBED IN ALL SHOP DRAWING SUBMISSION SHALL BE CAREFULLY CHECKED FOR ALL CLEARANCES (INCLUDING THOSE REQUIRED FOR MAINTENANCE AND SERVICING), FIELD CONDITIONS, MAINTENANCE OF ARCHITECTURAL CONDITIONS AND PROPER COORDINATION WITH ALL TRADES ON THE JOB.

C. EACH SUBMITTED SHOP DRAWING IS TO INCLUDE A CERTIFICATION THAT ALL RELATED JOB CONDITIONS HAVE BEEN CHECKED AND VERIFIED AND THAT THERE ARE NO CONFLICTS.

D. ALL SHOP DRAWINGS ARE TO BE SUBMITTED TO ALLOW 5 BUSINESS DAYS FOR CHECKING IN ADVANCE OF FIELD REQUIREMENTS. ALL SUBMITTALS TO BE COMPLETE AND CONTAIN ALL REQUIRED AND DETAILED INFORMATION. SHOP DRAWINGS WITH MULTIPLE PARTS SHALL BE SUBMITTED AS A PACKAGE.

E. IF SUBMITTALS DIFFER FROM THE CONTRACT DOCUMENT REQUIREMENTS, MAKE SPECIFIC MENTION OF SUCH DIFFERENCES IN A LETTER OF TRANSMITTAL, WITH REQUEST FOR SUBSTITUTION, TOGETHER WITH REASONS FOR SAME.

F. ELECTRONIC COPIES OF ENGINEERING DRAWINGS:

i. IF THE CONTRACTOR REQUIRES (.DWG) FORMAT. THE DRAWINGS WILL BE FORWARDED ONLY UPON RECEIPT OF SIGNED ACCEPTANCE OF TERMS FORM. PERMISSION FROM THE ARCHITECT MUST FIRST BE OBTAINED FOR ENGINEER TO INCLUDE THE ARCHITECTURAL BACKGROUND AS REFERENCE. THE CONTRACTOR IS TO OBTAIN THE ARCHITECT'S LATEST DRAWINGS DIRECTLY FROM THE ARCHITECT.

ii. THESE FILES ARE BEING ISSUED FOR THE CONVENIENCE OF THE CONTRACTOR AND THE CONTRACTOR REMAINS RESPONSIBLE FOR ALL CONTRACT REQUIREMENTS RELATED TO THE NORMAL SHOP DRAWING PREPARATION PROCESS.

G. SUBMISSIONS:

i. PROVIDE ALL COORDINATION DRAWINGS, DUCTWORK AND PIPING SHOP DRAWINGS IN PDF FORMAT – PAPER SUBMISSIONS SHALL NOT BE ACCEPTED.

THE ARCHITECT WILL FORWARD ALL SUBMISSIONS TO THE ENGINEER.

H. SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:

i. SHEET METAL SHOP DRAWING (3/8 INCH SCALE)

ii. SHEET METAL & PIPING SHOP STANDARDS

SHEETMETAL SHOP STANDARDS SHALL BE COMPILED DIRECTLY FROM THE “SMACNA DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE” MANUAL. MODIFICATIONS FOR A SPECIFIC PROJECT, IF ANY, SHALL BE INDICATED DIRECTLY ON THE SMACNA TEMPLATES. MODIFIED SHOP STANDARDS NOT TAKEN DIRECTLY FROM THE SMACNA TEMPLATES WILL NOT BE ACCEPTED. ANY DEVIATIONS FROM SMACNA SHALL BE NOTED.

iii. AC UNITS

iv. FANS

v. PIPING LAYOUT: DETAIL, AT 3/8 INCH SCALE PIPING LAYOUT WITH FITTINGS, VALVES AND EQUIPMENT, USE SINGLE LINE FOR PIPE SIZES 3 INCHES AND SMALLER, AND DOUBLE LINE FOR PIPE SIZES 4 INCHES AND GREATER. FABRICATION OF PIPE ANCHORS, HANGERS, SUPPORTS FOR MULTIPLE PIPES, ALIGNMENT GUIDES, EXPANSION JOINTS AND LOOPS, AND ATTACHMENTS OF THE SAME TO THE BUILDING STRUCTURE. DETAIL LOCATION OF ANCHORS, ALIGNMENT GUIDES, AND EXPANSION JOINTS AND LOOPS SUBMIT ALL WELDING CERTIFICATES.

vi. VIBRATION ISOLATION

vii. DAMPER AND VALVE ACTUATORS

viii. AUTOMATIC CONTROL SYSTEMS AND DEVICES

ix. SEQUENCE OF OPERATIONS

I. COORDINATION DRAWINGS: CONTRACTOR SHALL PROVIDE PLANS AT 3/8 INCH SCALE INDICATING COORDINATION BETWEEN THE TRADES USING INPUT FROM INSTALLERS OF THE ITEMS INVOLVED.

i. DUCT AND PIPING INSTALLATION INDICATING COORDINATION WITH GENERAL CONSTRUCTION, BUILDING COMPONENTS, AND OTHER BUILDING SERVICES. INDICATE LOCATIONS AND SIZES OF ALL OPENINGS IN FLOOR, WALLS AND ROOF THAT MAY BE REQUIRED.

ii. COORDINATION WITH SUSPENDED CEILING COMPONENTS, STRUCTURAL MEMBERS TO WHICH DUCT WILL BE ATTACHED, SIZE AND LOCATION OF INITIAL

ACCESS MODULES FOR ACOUSTICAL TILE, PENETRATIONS OF SMOKE BARRIERS AND FIRE-RATED CONSTRUCTION, LIGHTING FIXTURES, AIR OUTLETS AND INLETS, SPEAKERS, SPRINKLERS, ACCESS PANELS, PERIMETER MOLDINGS SHALL BE PERFORMED.

4. AS-BUILTS AND EQUIPMENT OPERATION INSTRUCTIONS

A. PROVIDE ALL COORDINATION DRAWINGS, DUCTWORK AND PIPING AS-BUILTS IN AUTOCAD 2013 AND PDF FORMAT. ALL CATALOG CUTS AND SUBMITTALS TO BE PROVIDED IN ELECTRONIC PDF FORMAT. THE ARCHITECT WILL FORWARD ALL SUBMISSIONS TO THE ENGINEER.

B. ON COMPLETION AND ACCEPTANCE OF WORK, THIS CONTRACTOR SHALL FURNISH WRITTEN INSTRUCTIONS, EQUIPMENT MANUALS AND DEMONSTRATE TO THE OWNER THE PROPER OPERATION AND MAINTENANCE OF ALL EQUIPMENT AND APPARATUS FURNISHED UNDER THIS CONTRACT.

C. THESE INSTRUCTIONS SHALL BE TYPED ON 8-1/2 INCH X 11 IN FORMAT. THE CONTRACTOR SHALL GIVE ONE COPY OF THE INSTRUCTIONS TO THE OWNER AND ONE COPY TO THE ENGINEER.

D. THE INSTRUCTIONS SHALL BE ORGANIZED IN SECTIONS, WITH ONE SECTION PER SYSTEM. THE COVER OF THE INSTRUCTION BOOKLET SHALL BEAR THE NAME, ADDRESS AND PHONE NUMBER OF THE PROJECT, ARCHITECT, ENGINEER, MECHANICAL CONTRACTOR AND SUBCONTRACTORS.

E. FINAL AS-BUILT DRAWINGS INDICATING AS INSTALLED CONDITIONS SHALL BE PROVIDED TO THE ARCHITECT AND ENGINEER AFTER COMPLETION OF THE INSTALLATION.

5. SUBSTITUTIONS

A. NO SUBSTITUTE MATERIAL OR MANUFACTURER OF EQUIPMENT SHALL BE PERMITTED WITHOUT A FORMAL WRITTEN SUBMITTAL TO THE ENGINEER WHICH INCLUDES ALL DIMENSIONAL, PERFORMANCE AND MATERIAL SPECIFICATIONS. ANY CHANGES IN LAYOUT, ELECTRICAL CHARACTERISTICS, STRUCTURAL REQUIREMENTS OR DESIGN DUE TO THE USE OF A SUBSTITUTION SHALL BE SUBMITTED TO THE ENGINEER AS PART OF THIS PROPOSAL. THE CONTRACTOR TAKES FULL RESPONSIBILITY FOR THE SUBSTITUTION AND ALL CHANGES RESULTING FROM THE SUBSTITUTION. ALL ITEMS SHALL BE SUBMITTED FOR REVIEW IN CONJUNCTION WITH THE SUBMITTAL OF THE SUBSTITUTION. ANY SUBSTITUTION MUST BE SUBMITTED WITH AN EXPLANATION WHY A SUBSTITUTION IS BEING UTILIZED. IF THE SUBSTITUTED ITEM DEVIATES FROM THE SPECIFIED ITEM, THOSE DEVIATIONS ARE TO BE IDENTIFIED ON A LINE BY LINE BASIS. IF THE SUBSTITUTE IS BEING UTILIZED FOR FINANCIAL REASONS, THE ASSOCIATED CREDIT MUST BE SIMULTANEOUSLY SUBMITTED.

B. ALL SUBSTITUTED EQUIPMENT SHALL CONFORM TO SPACE REQUIREMENTS AND PERFORMANCE REQUIREMENTS SHOWN ON CONTRACT DOCUMENTS. CONTRACTOR

SHALL REPLACE ANY EQUIPMENT THAT DOES NOT MEET THESE REQUIREMENTS AT HIS OWN EXPENSE. ANY MODIFICATIONS TO ASSOCIATED SYSTEMS OR ADDITIONAL COSTS ATTRIBUTED TO THIS SUBSTITUTION SHALL BE AT THIS CONTRACTOR'S EXPENSE.

C. CONTRACTOR SHALL SUBMIT BID BASED ON SPECIFIED ITEMS AND SHALL SUPPLY AS AN ALTERNATE PRICE ANY SUBSTITUTIONS.

6. SERVICE AND WARRANTY (MAINTENANCE CONTRACT)

A. THIS CONTRACTOR SHALL PROVIDE AS AN ADD ALTERNATE PRICE, A FULL ONE YEAR SERVICE OF ALL MECHANICAL COMPONENTS AND SYSTEMS, WITH PRICES FOR YEARS 2, 3 AND 4 FOLLOWING THIS FIRST YEAR. AT THE TIME OF ACCEPTANCE OF PROJECT, THE TENANT OR OWNER'S REPRESENTATIVE WILL DECIDE TO ACCEPT WHICH ALTERNATE, IF ANY. THIS IS IN ADDITION TO THE WARRANTY BEING PROVIDED AS PART OF THE BASE CONTRACT.

7. ACCESS DOORS IN GENERAL CONSTRUCTION

A. THIS CONTRACTOR SHALL SUBMIT TO THE ARCHITECT FOR APPROVAL A PLAN INDICATING THE SIZE (MINIMUM 18 INCH X 18 INCH) AND LOCATION OF ALL ACCESS DOORS REQUIRED FOR OPERATION AND MAINTENANCE OF ALL CONCEALED EQUIPMENT, DEVICES, VALVES, DAMPERS AND CONTROLS. CONTRACTOR SHALL ARRANGE FOR FURNISHING AND INSTALLATION OF ALL ACCESS DOORS IN FINISHED CONSTRUCTION AND INCLUDE COSTS IN THE BID.

B. REMOVABLE ACCESS TILE AND/OR ACCESS DOOR ARE REQUIRED IN HUNG CEILINGS, SHAFTS AND WALLS FOR ALL EQUIPMENT, DAMPERS, VALVES, ETC. HVAC CONTRACTOR TO FURNISH ACCESS LOCATION REQUIREMENTS TO GENERAL CONTRACTOR. ACCESS TILE IDENTIFICATION: PROVIDE BUTTONS, TABS, AND MARKERS TO IDENTIFY LOCATION OF CONCEALED VALVES, DAMPERS AND EQUIPMENT.

8. SHEET METAL WORK

A. DUCT CONSTRUCTION, INCLUDING SHEET METAL THICKNESSES, SEAM AND JOINT CONSTRUCTION, REINFORCEMENTS, HANGERS AND SUPPORTS, SHALL COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" LATEST EDITION AND PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA INDICATED.

B. EXCEPT AS OTHERWISE SHOWN OR NOTED, ALL DUCTWORK AND OTHER SHEET METAL WORK SHALL BE GALVANIZED SHEET STEEL

C. DESCRIPTION OF DUCTWORK PRESSURE CLASS AND EQUIPMENT:

i. 2 INCH DUCT CLASS AND LESS: ALL OTHER LOW PRESSURE DUCTOWORK. SEAL CLASS C, LEAKAGE CLASS 24 (RECTANGULAR) OR CLASS 12 (ROUND).

ii. 3 INCH DUCT CLASS: ALL SUCTION AND DISCHARGE OF KITCHEN EXHAUST AND OTHER EXHAUST DUCTWORK. SEAL CLASS B, LEAKAGE CLASS 12 RECTANGULAR METAL OR CLASS 6 (ROUND).

iii. 4 INCH AND GREATER DUCT CLASS: ALL SUPPLY/RETURN DUCTWORK FROM DISCHARGE/INTAKE OF FANS, AIR HANDLING UNITS OR AC UNITS TO INLET/OUTLET OF TERMINAL BOXES ON FLOOR, ALL OUTDOOR DUCTWORK AND ALL DUCTWORK RUNNING THROUGH UNCONDITIONED SPACES. SEAL CLASS A, LEAKAGE CLASS 6 (RECTANGULAR METAL) OR CLASS 3 (ROUND).

D. GENERAL FABRICATION REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", LATEST EDITION, BASED ON INDICATED STATIC-PRESSURE CLASS UNLESS OTHERWISE INDICATED.

i. THE FOLLOWING FITTING CONNECTIONS AND DUCT CONSTRUCTION GAUGES ARE NOT ACCEPTABLE

a) DRIVE SLIP [T-1, T-2] FITTING CONNECTIONS

b) 26 GAUGE DUCTWORK.

ii. TRANSVERSE JOINTS: SELECT JOINT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", "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." FITTINGS AND/OR JOINTS OF TWO DIFFERENT GAUGES, CONNECTED JOINT RATING SHALL MEET MORE STRINGENT CONDITIONS.

iii. USE THE FOLLOWING SMACNA TRANSVERSE (GIRTH) JOINTS

a) DUCT CONSTRUCTION AS FOLLOWS FOR 2 INCH W.G. CLASS:
(1) UP TO 12 INCH WIDE USE T-6 OR T-7
(2) 13 INCH TO 28 INCH WIDE USE T-11 OR T12
(3) 29 INCH WIDE AND UP USE TDC OR TDF

b) DUCT CONSTRUCTION AS FOLLOWS FOR 3 INCH W.G. CLASS:
(1) UP TO 20 INCH WIDE USE T-6 OR T-7
(2) 21 INCH TO 24 INCH WIDE USE T-11 OR T12
(3) 25 INCH WIDE AND UP USE TDC OR TDF

c) DUCT CONSTRUCTION AS FOLLOWS FOR 4 INCH W.G. CLASS:
(1) UP TO 12 INCH WIDE USE T-6 OR T-7
(2) 13 INCH TO 18 INCH WIDE USE T-11 OR T12
(3) 19 INCH WIDE AND UP USE TDC OR TDF

E. VOLUME DAMPERS: GALVANIZED STEEL, PER SMACNA "LOW VELOCITY MANUAL,"

EXCEPT PROVIDE BEARING AT ONE END OF DAMPER ROD AND QUADRANT, WITH LEVER AND LOCKSCREW AT OTHER END. FOR INSULATED DUCTS, QUADRANTS MOUNTED ON COLLAR TO CLEAR INSULATION. INSTALL WITH LEVERS ACCESSIBLE.

i. PROVIDE MANUAL BALANCING VOLUME DAMPERS AS REQUIRED TO PROPERLY BALANCE THE AIR DISTRIBUTION SYSTEM. IF THE LOCATION OF BALANCING DAMPERS ARE NOT DEFINED ON THE DRAWINGS, THE FOLLOWING MINIMUM STANDARDS SHALL GOVERN:

a) LOW PRESSURE: ALL SUPPLY AIR MAIN BRANCHES FROM TRUNK, EACH SPLIT, AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.

b) LOW PRESSURE: ALL EXHAUST AND RETURN BRANCHES FROM TRUNK, EACH SPLIT AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.

F. FLEXIBLE DUCTWORK SHALL NOT BE USED ON THIS PROJECT.

G. ACCESS DOORS: INSULATED OR UNINSULATED, SAME AS DUCT.

i. PROVIDE MINIMUM 20 INCH X 14 INCH ON MAIN DUCTS, AND 12 INCH X 6 INCH ON BRANCH DUCTS, UNLESS OTHERWISE APPROVED, AT FIRE DAMPERS, AND AT ALL DUCT ACCESSORIES SUCH AS HUMIDIFIERS, DUCT SMOKE DETECTORS, AUTO DAMPERS, AND LOUVERS.

ii. ALL ACCESS DOORS TO BE HINGED, WITH LATCH SIMILAR TO VENTLOCK NO. 100.

H. FLEXIBLE CONNECTIONS: NEOPRENE-COATED GLASS FABRIC, 30 OZ PER SQUARE YD WITH SEWED AND CEMENTED SEAMS, SIMILAR TO VENT FABRICS. PROVIDE WITH METAL COLLARS. ALLOW MINIMUM MOVEMENT OF 1 INCH.

I. TURNING VANES: GALVANIZED STEEL SMALL DOUBLE-THICKNESS VANES WITH 2 INCH INSIDE RADIUS.

J. FIRE DAMPERS: DYNAMIC; RATED AND LABELED ACCORDING TO UL 555 BY AN NRTL GALVANIZED STEEL CONSTRUCTION, CURTAIN TYPE WITH BLADES OUT OF THE AIRSTREAM (TYPE B), SPRING LOADED, EQUIPPED WITH FUSIBLE LINK, CONFORMING TO NFPA STANDARD 90A AND APPROVED BY NEW YORK CITY, SIMILAR TO POTOROFF OR RUSKIN, RATED AS REQUIRED. PROVIDE FIRE DAMPERS AS NOTED ON THE PLANS AND IN DUCTS AND OPENINGS IN SHAFTS, FLOORS, FIRE WALLS, FIRE-RESISTANCE PARTITIONS, FIRE RATED CEILINGS, EXIT CORRIDOR WALLS. PROVIDE ACCESS DOOR IN DUCT ADJACENT TO EACH FIRE DAMPER. SEE INSTALLATION ON DRAWING.

K. COMBINATION FIRE/SMOKE DAMPERS:

i. COMBINATION FIRE/SMOKE DAMPERS SHALL BE INSTALLED AS INDICATED ON

DRAWING AND AS REQUIRED BY LOCAL CODES. DAMPERS TO BE UL 555S LATEST EDITION LISTED AND LABELED AND IN CONFORMANCE WITH NFPA.

ii. COMBINATION FIRE/SMOKE DAMPERS SHALL BE CLASS 1 (ONE), DUAL OVERRIDE REMOTE RESETTABLE, OPPOSED MULTIBLADE TYPE WITH FIRESTAT OR EQUIVALENT HEAT RESPONSIVE DEVICE, 120-VOLT ACTUATOR AS REQUIRED MOUNTED OUT OF THE AIR STREAM, WITH DAMPER OPERATOR AND BLADE POSITION INDICATOR SWITCHES. PROVIDE MOTOR MOUNT BRACKET STRENGTHENER FOR DAMPERS OVER 10 INCH IN HEIGHT. PROVIDE A 10 GAUGE WELDED VERTICAL STIFFENER AT EACH CORNER TO PREVENT DAMPER MISALIGNMENT.

iii. PROVIDE ACCESS DOOR IN DUCT ADJACENT TO EACH FIRE/SMOKE DAMPER.

iv. PROVIDE FIRE/SMOKE DAMPERS AS NOTED ON THE PLANS AND IN DUCTS AND OPENINGS IN SHAFTS, FLOORS, FIRE WALLS, FIRE-RESISTANCE PARTITIONS, FIRE RATED CEILINGS AND SMOKE BARRIERS.

v. THE HVAC CONTRACTOR SHALL PROVIDE ALL DEVICES, RELAYS, END SWITCHES, E/P SWITCHES, CONTROL COMPONENTS, AIR PIPING, POWER WIRING, CONTROL WIRING AND INTERLOCK WIRING AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF OPERATION FOR THESE DAMPERS.

vi. DAMPERS SHALL BE MANUFACTURED BY GREENHECK MODEL FSD-311, RUSKIN MODEL FSD-60, OR APPROVED EQUAL.

vii. MODULATING COMBINATION FIRE/SMOKE DAMPERS TO BE PROVIDED WITH ACTUATORS RATED AND TESTED FOR THIS APPLICATION.

viii. SEE INSTALLATION ON DRAWING.

L. ALL DUCT DIMENSIONS INDICATED ON PLANS ARE INSIDE CLEAR DIMENSIONS. INCREASE DUCT DIMENSIONS AS REQUIRED TO ACCOUNT FOR INTERNAL LINING.

M. AUTOMATIC DAMPERS: COMPLETE WITH LINKAGE AND ELECTRIC OPERATOR. OPPOSED BLADE DAMPER OR GALVANIZED STEEL MIN. 4 INCH, MAX. 8 INCH WIDE WITH COMPRESSIBLE EDGE SEALS TO PREVENT LEAKAGE. FACTORY-ASSEMBLE STEEL LINKAGE AND SHAFT WITH NYLON OR OIL-IMPREGNATED BRONZE BEARINGS. MOTOR WITH SUFFICIENT POWER TO LIMIT LEAKAGE TO 10 CFM PER SQUARE FEET. LINKAGE TO WITHSTAND LOAD EQUAL TO TWICE MAXIMUM OPERATING FORCE WITHOUT DEFLECTION. DAMPER MOUNTED IN WELDED STEEL CHANNEL FRAME.

i. SHUTOFF DAMPERS SHALL BE CLASS I MOTORIZED DAMPERS WITH AN AIR LEAKAGE RATE NOT GREATER THAN 4 CFM/SF OF DAMPER SURFACE AREA AT 1.0 INCH WG AND AMCA 500D LISTED.

N. EXTERIOR LOUVERS: 4 INCH WIDE STATIONARY LOUVER, EXTRUDED ALUMINUM, 0.081 INCH WALL THICKNESS, 6063T5 ALLOY BLADES AND FRAME WITH STAINLESS STEEL OR

ALUMINUM FASTENERS. LOUVER TO INCORPORATE STRUCTURAL SUPPORT TO WITHSTAND WIND LOAD OF 20 LBS PER SQUARE FEET. PROVIDE REMOVABLE 3/4 INCH X 3/4 INCH ALUMINUM BIRDSCREEN IN AN ALUMINUM FRAME. AIR PERFORMANCE AND WATER PENETRATION LESS THAN OR EQUAL TO GREENHECK. COORDINATE ALL REQUIREMENTS WITH THE BUILDING MANAGEMENT AND ARCHITECT. LOUVER TO COMPLY WITH BASE BUILDING STANDARDS.

O. ALUMINUM DUCTWORK:

i. ALUMINUM SHEETS: COMPLY WITH ASTM B 209ALLOY 3003, H14 TEMPER; WITH MILL FINISH FOR CONCEALED DUCTS, AND STANDARD, ONE-SIDE BRIGHT FINISH FOR DUCT SURFACES EXPOSED TO VIEW.

ii. ALL OUTSIDE AIR, EXHAUST, AND RELIEF DUCTWORK WITHIN 5 FEET OF LOUVERS SHALL BE ALUMINUM WITH SEAMS SEALED WATERTIGHT WITH ALCOA ALUMINASTIC TYPE C SEAM SEALER OR SOLDER. PITCH DUCTWORK TOWARDS LOUVER.

P. WIRE MESH SCREEN (WMS): NO. 16 USSG, 3/4 SQUARE MESH, IN 1 INCH WIDE GALVANIZED STEEL ENCLOSING FRAME. FLANGED DUCT OPENING TO RECEIVE FRAME.

Q. LEAKAGE TESTING:

I. ALL DUCTWORK GREATER THAN 2 INCH CLASS AS DEFINED WITHIN IS TO BE TESTED. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL COLLARS, CAPS, ELECTRIC POWER, ETC. NECESSARY TO PERFORM THE TESTS. THE CONTRACTOR IS ALSO RESPONSIBLE FOR SCHEDULING THE TEST NO LESS THAN THREE (3) BUSINESS DAYS PRIOR TO ITS INTENDED OCCURRENCE. LOW PRESSURE DUCTWORK (2 INCH CLASS) SHALL BE TESTED ON AN AS NEEDED BASIS AT THE ENGINEER'S DIRECTION. LEAKAGE TEST PROCEDURE SHALL FOLLOW THE OUTLINES AND CLASSIFICATIONS IN THE SMACNA HVAC DUCT LEAKAGE TEST MANUAL. IF SPECIMEN FAILS TO MEET ALLOTTED LEAKAGE LEVEL, THE CONTRACTOR SHALL MODIFY TO BRING IT INTO COMPLIANCE AND SHALL RETEST IT UNTIL ACCEPTABLE LEAKAGE IS DEMONSTRATED. TESTS AND NECESSARY REPAIR SHALL BE COMPLETED AND A REPORT SHALL BE SUBMITTED TO AND APPROVED BY ENGINEER PRIOR TO CONCEALMENT OF DUCTS.

9. AIR OUTLETS

A. GENERAL:

i. MARGIN TYPES, COLORS, FINISH AND METHODS OF ATTACHMENT FOR ALL DIFFUSERS, GRILLES AND REGISTERS SHALL BE COORDINATED WITH ARCHITECTURAL CEILING AND WALL DETAILS AND SPECIFICATIONS. FINISH SHALL MATCH COLOR SAMPLE AS APPROVED:

ii. FRAME TYPE SUITABLE FOR MOUNTING IN CEILING OR WALL CONSTRUCTION AS INDICATED ON ARCHITECTURAL PLANS.

iii. EXACT LOCATION OF ALL AIR OUTLETS AS PER ARCHITECTURAL PLANS.

iv. PROVIDE MOUNTING AND BLOCKING

v. SUITABLE FOR OPERATION AT 20% EXCESS AND 20% LESS THAN NOTED CAPACITY FOR CONSTANT VOLUME SYSTEMS AND AT 20% EXCESS AND 60% LESS THAN NOTED CAPACITY FOR VARIABLE VOLUME SYSTEMS.

vi. MANUFACTURER RESPONSIBLE FOR EXAMINING APPLICATION OF EACH OUTLET AND GUARANTEE THAT EACH WILL PROVIDE REQUIRED NC LEVELS AND COMFORT SPACE CONDITIONS WITHOUT DRAFTS THROUGHOUT OPERATING RANGE.

vii. ALL REGISTERS SHALL BE PROVIDED WITH OPPOSED BLADE VOLUME DAMPERS. DAMPER OPERATING LEVERS SHALL BE ACCESSIBLE AT THE FACE OF AIR OUTLETS. CEILING DIFFUSERS SHALL NOT HAVE BUTTERFLY DAMPERS WITHIN NECK.

viii. ONLY FOUR (4) WAY DIFFUSERS SHALL BE PROVIDED. PROVIDE SHEETMETAL BLANK OFF AS REQUIRED FOR 1 WAY, 2 WAY OR 3 WAY DIFFUSERS.

ix. PROVIDE BLANKING FOR PROPER COVERAGE AND BLOW WITHOUT PRODUCING OBJECTIONABLE NOISE OR AIR MOTION AT OCCUPIED LEVEL.

x. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

a) ANEMOSTAT PRODUCTS; A MESTEK COMPANY.

b) TITUS.

c) PRICE INDUSTRIES

B. LINEAR DIFFUSERS: EXTRUDED ALUMINUM CONSTRUCTION, FINISH AS PER ARCHITECT, REMOVABLE CORE, AIR DEFLECTION VANE AND CABLE DAMPER IN EACH BRANCH TAP WITH 3 FEET CABLE TO DIFFUSER FACE.

i. LINEAR DIFFUSERS: FRAME TYPES SHALL MATE WITH CEILINGS. PROVIDE MEANS TO NEATLY BUTT AND ALIGN UNITS TO GIVE CONTINUOUS APPEARANCE WITHOUT BUTTING FLANGES. NO SCREW HOLES OR WELDED CORNERS VISIBLE ON DIFFUSERS OR FRAMES WILL BE PERMITTED. AIR VOLUME SHALL BE ADJUSTABLE THROUGH AIR SUPPLY FACE WITHOUT REQUIRING REMOVAL OF FACE PANEL. PROVIDE BLANKED SECTIONS FOR INACTIVE LENGTHS. PROVIDE PLASTER FRAMES AND OPPOSED BLADE VOLUME DAMPERS WITH REMOTE CABLE OPERATORS WHERE NOTED. REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING DETAILS AND OVERALL LENGTHS.

C. SQUARE DIFFUSERS: DIFFUSERS SHALL BE STEEL CONSTRUCTION PAINTED WHITE SUITABLE FOR THE TYPE OF CEILING.

D. REGISTERS AND GRILLES:

i. RETURN AND EXHAUST REGISTERS: STEEL CONSTRUCTION WITH VOLUME DAMPER.

ii. SUPPLY REGISTERS: STEEL CONSTRUCTION ADJUSTABLE DOUBLE DEFLECTION STEEL AIRFOIL LOUVERS, WITH VOLUME DAMPER. PROVIDE AIR EQUALIZING DEFLECTOR WHERE REGISTER COLLAR DUCT IS LESS THAN 2 FEET LONG.

iii. TRANSFER GRILLES: STEEL CONSTRUCTION WITHOUT VOLUME DAMPER.

10. NOISE CONTROL

A. ALL ROOM NC LEVELS SHALL BE 35 OR LESS.

B. PROVIDE SOUNDLINING FOR THE FOLLOWING DUCTWORK:

i. ALL DUCTWORK WITHIN MECHANICAL ROOMS AND NOT LESS THAN 25 FEET ON EACH SIDE OF ALL FANS AND AC UNITS.

ii. ALL AIR TRANSFER AND JUMPER DUCTS.

iii. RETURN AIR STUB DUCTS AT MER WALLS AND SHAFT INTAKE OPENINGS FOR FULL LENGTH.

iv. DOWNSTREAM OF ALL TERMINAL BOXES (CV, VAV) FOR A MINIMUM OF 15 FEET).

v. ALL MIXED AIR PLENUMS, EXCEPT WHERE MOISTURE CARRYOVER FROM OUTDOOR AIR LOUVER WILL OCCUR.

vi. EXPOSED SUPPLY DUCTWORK SHALL BE ACOUSTICALLY LINED IN LIEU OF EXTERNAL INSULATION.

vii. ALSO WHERE NOTED ON A DRAWING.

C. SOUNDLINING IN DUCTWORK: FIBROUS GLASS, MINIMUM 3 LB DENSITY, 1-1/2 INCH THICKNESS, MAXIMUM 0.25 K FACTOR AT 75°F MEAN TEMPERATURE WITH ACRYLIC COATED FINISH FACTORY APPLIED EDGE COATING AND STENCILED IN ACCORDANCE WITH NFPA 90. FLAMESPREAD SHALL BE A MAXIMUM OF 25. LINING SHALL NOT SUPPORT MICROBIAL GROWTH AND SHALL BE TESTED IN ACCORDANCE WITH ASTM C 1071 AND ASTM G21/G22. SIMILAR TO MANVILLE PERMACOTE LINACOUSTIC.

D. ALL SOUNDLINING, ADHESIVES, FACES AND ACCESSORIES TO BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, EXCEPT AS OTHERWISE

NOTED.

11. TESTING AND BALANCING

A. ALL AIR AND WATER BALANCING SHALL BE BY AN INDEPENDENT CONTRACTOR NOT AFFILIATED WITH THE MECHANICAL CONTRACTOR AND IN ACCORDANCE WITH LOCAL STANDARDS. CONTRACTOR SHALL UTILIZE BASE BUILDING BALANCING CONTRACTOR OR APPROVED EQUAL, CONTACT BUILDING MANAGEMENT.

B. CONTRACTOR TO BALANCE ENTIRE SYSTEM TO AIR AND/OR WATER QUANTITIES AS SHOWN ON ALL RELATED DRAWINGS FOR THIS JOB, AND AS DESCRIBED HEREIN. BALANCING MUST BE DONE IN THE PRESENCE OF A BUILDING ENGINEER.

C. AIR BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF FANS AND BRANCH DAMPERS FOR MAJOR ADJUSTMENTS. AIR SUPPLY OUTLETS TO BE BALANCED TO A UNIFORM SUPPLY ACROSS ENTIRE FACE. ADJUSTMENT OF TERMINAL DAMPERS AND DEVICES SHALL BE FOR TRIM OR MINOR ADJUSTMENT ONLY. THIS SHALL BE DONE TO PERMIT THE LEAST NOISE GENERATION IN THE TERMINAL AREAS AND UTILIZE MINIMUM FAN ENERGY.

D. WATER BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF BALANCING VALVES AT PUMPS FOR PROPER FLOW. ADJUST FLOW THROUGH COILS AS REQUIRED.

E. UPON COMPLETION OF THE INSTALLATION, THE CONTRACTOR SHALL REBALANCE ANY EXISTING PORTIONS OF AIR DISTRIBUTION SYSTEM AND WATER DISTRIBUTION SYSTEM AFFECTED BY THE RENOVATION AND ALSO BALANCE ALL NEW WORK.

F. IF DISCREPANCIES EXIST IN THE REPORT THAT REQUIRE FIELD VERIFICATION, THE TESTING AND BALANCING COMPANY IN THE PRESENCE OF THE ENGINEER SHALL VISIT THE JOBSITE FOR FIELD VERIFICATION OF THE REPORT.

G. THE CONTRACTOR SHALL PROVIDE ALL LABOR, PRESSURE GAUGES, FLOW METERS, SHEAVES, AND BELTS REQUIRED TO BALANCE SYSTEMS.

H. BALANCING REPORT SHALL BE PROVIDED ON NEBB OR AABC-TYPE FORMS.

I. BALANCING AND TESTING SHALL BE PERFORMED AND SUPERVISED BY A CERTIFIED NEBB OR AABC TECHNICIAN.

J. BALANCING AND TESTING SHALL BE PERFORMED AND SUPERVISED BY ONE OF THE FOLLOWING INDEPENDENT FIRMS SPECIALIZING IN TESTING AND BALANCING:

I. INTERNATIONAL TESTING AND BALANCING

II. INDEPENDENT TESTING & BALANCING

III. MERENDINO ASSOCIATES.

K. THE PERFORMANCE AND CAPACITY OF ALL SYSTEMS AND EQUIPMENT TO BE DEMONSTRATED BY THE CONTRACTOR.

L. AFTER SUBMISSION OF THE FIELD VERIFIED BALANCING REPORT, THE AIR BALANCING COMPANY SHALL RETURN TO THE JOB SITE TO PERFORM TWO (2) OCCUPANT COMFORT BALANCES AS DIRECTED BY THE OWNER OR ENGINEER

M. THE FINAL REPORT AFTER THE COMFORT BALANCE IS TO BE INCLUDED IN PROJECT OPERATING AND MAINTENANCE MANUAL TO OWNER AND ENGINEER.

N. THE TESTING AND BALANCING AGENCY SHALL INCLUDE AS PART OF THEIR WORK AN EXTENDED WARRANTY OF 90 DAYS AFTER COMPLETION OF TEST AND BALANCE WORK. THE ENGINEER AT HIS DISCRETION DURING THE WARRANTY PERIOD MAY REQUEST A RECHECK, OR RESETTING OF ANY EQUIPMENT. THE MECHANICAL CONTRACTOR AND THE BALANCING CONTRACTOR SHALL PROVIDE THE NECESSARY TECHNICIANS TO FACILITATE THIS WORK.

O. BALANCING AGENCY SHALL PERMANENTLY MARK ALL ADJUSTMENT DEVICES (VALVES, DAMPERS, ETC.) TO ENABLE THE SETTING TO BE RESTORED.

P. AIR BALANCING:

i. PRE-CONSTRUCTION AIR TESTING: MEASURE PRESSURE, TEMPERATURE, AND VOLUME OF AIR FROM EXISTING BASE BUILDING SYSTEM BEFORE STARTING WORK. TRAVERSE MAIN SUPPLY AND RETURN DUCTS BEFORE WORK TO OBTAIN TOTAL FLOW. SUBMIT REPORT TO ENGINEER IMMEDIATELY AFTER COMPLETION OF TEST.

ii. HVAC CONTRACTOR SHALL ENSURE THAT A FIRST SET OF AIR FILTERS ARE IN PLACE, WHENEVER FANS ARE RUNNING AND REPLACED WITH A NEW CLEAN SET OF FILTERS BEFORE TESTING IS COMMENCED.

iii. TEST, ADJUST, REPLACE SHEAVES, AND BALANCE ALL EQUIPMENT AND AIR DISTRIBUTION SYSTEMS TO PROVIDE AIR QUANTITIES INDICATED ON PLANS WITHIN PLUS OR MINUS 5 PERCENT.

iv. TEST REPORT SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

a) FLOW, LEAKAGE CLASS, TEMPERATURE, STATIC PRESSURE OF AIR AT ALL TRUNK DUCTS SERVING AREAS OF WORK.

b) TEMPERATURE OF AIR LEAVING OUTLETS AT TWO (2) TYPICAL AIR OUTLETS.

c) QUANTITY OF AIR AT EACH AIR INLET AND OUTLET AFTER BALANCING.

d) PROVIDE FOR ALL FANS, FAN MOTOR HP, AMPS, VOLTS, FAN RPM, CFM, INLET AND DISCHARGE STATIC PRESSURE, SHEAVE POSITION.

e) PROVIDE FOR ALL AIR CONDITIONING UNITS, SUPPLY CFM, OUTSIDE AIR CFM, RETURN AIR CFM, MIXED AIR CFM. PROVIDE OUTSIDE AIR, MIXED AIR AND SUPPLY AIR TEMPERATURES (DRY BULB - COOLING AND HEATING, WET-BULB-COOLING.) INDICATE UNIT OPERATING MODE DURING TEST.

f) CALIBRATE ALL NEW TERMINAL BOXES (VAV) AS REQUIRED TO MEET SPECIFIED MINIMUM/MAXIMUM CFM.

g) LISTING OF DESIGN AND ACTUAL READINGS AS WELL AS ALL MANUFACTURER'S DATA FOR EQUIPMENT.

12. INSULATION - GENERAL REQUIREMENTS

A. ALL INSULATION MATERIALS, INCLUDING JACKETS, FACING, ADHESIVE, COATINGS, AND ACCESSORIES ARE TO BE FIRE HAZARD RATED AND LISTED BY UNDERWRITERS LABORATORIES, INC. USING STEINER TUNNEL TEST METHOD FOR FIRE HAZARD CLASSIFICATION OF BUILDING MATERIALS, STANDARD UL 723 (ASTM E-84), (ASA A2.5-1963). FLAMESPREAD: MAXIMUM 25. FUEL CONTRIBUTED AND SMOKE DEVELOPED: MAXIMUM 50. FLAMEPROOFING TREATMENTS SUBJECT TO DETERIORATION FROM MOISTURE OR HUMIDITY ARE NOT ACCEPTABLE.

B. PRODUCTS SHALL NOT CONTAIN ASBESTOS, LEAD, MERCURY, OR MERCURY COMPOUNDS.

C. DEFINITIONS:

i. EXPOSED: INDOOR DUCTS, PIPING OR EQUIPMENT LOCATED IN MECHANICAL EQUIPMENT ROOMS AND IN AREAS WHICH WILL BE VISIBLE WITHOUT REMOVING CEILINGS OR OPENING ACCESS PANELS.

ii. CONCEALED: INDOOR DUCTS, PIPING OR EQUIPMENT WHICH IS NOT EXPOSED.

iii. OUTDOOR: DUCTS, PIPING OR EQUIPMENT WHICH IS EXPOSED TO THE WEATHER.

13. DUCTWORK INSULATION

A. INSULATE ALL DUCTWORK IN ACCORDANCE WITH INSULATION SCHEDULE ON M-600 DRAWING EXCEPT AS OTHERWISE NOTED.

B. REINSULATE ALL DUCTWORK AND PIPING WHICH IS EXISTING AND DAMAGED DURING CONSTRUCTION OR REQUIRED TO BE RELOCATED. INSULATE WITH SAME MATERIAL AND THICKNESS.

C. NON-INSULATED DUCTWORK:

i. WHERE SOUNDLINING IS OF MINIMUM THICKNESS SPECIFIED FOR INSULATION.

ii. AIR CONDITIONING RETURN AIR DUCTWORK EXPOSED IN AIR CONDITIONED SPACES AND INSTALLED IN HUNG CEILINGS WHERE SPACE IMMEDIATELY ABOVE AND BELOW ARE BOTH AIR CONDITIONED.

D. MATERIAL:

i. TYPE D-1: MINIMUM 1-LB DENSITY FIBERGLASS BLANKET, MAXIMUM 0.28 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY-APPLIED FOIL-SKRIM-KRAFT FACING SIMILAR TO MANVILLE MICROLITE.

ii. TYPE D-2: 3 LB. FIBERGLASS BOARD. THE MAXIMUM K FACTOR SHALL BE 0.23 AT 75°F MEAN TEMPERATURE WITH A MINIMUM DENSITY OF 3 LB. THE INSULATION SHALL BE PROVIDED WITH A FACTORY-APPLIED ALL PURPOSE OR ALL SERVICE FACING. THE INSULATION SHALL BE EQUAL TO MANVILLE TYPE 814 SPIN-GLAS AP.

iii. TYPE D-3: MINIMUM 6 LB FIBERGLASS BOARD. MAXIMUM 0.22 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY APPLIED ALL PURPOSE OR ALL SERVICE FACING. SIMILAR TO MANVILLE 817 SPIN-GLAS AP.

E. INSTALLATION:

i. FIBERGLASS BLANKET: 2 INCH LAP STRIPS AT ALL SEAMS. SECURE BOTTOM OF ALL DUCTS OVER 24 INCH WIDE WITH MIN. 2 ROWS OF WELD PINS 12 INCH ON CENTER. SECURE ALL SEAMS WITH FOIL VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE.

ii. FIBERGLASS BOARD: SEAL JOINTS AND BREAKS IN FACING WITH 3 INCH WIDE TAPE TO MATCH FACING AND ADHERE WITH VAPOR SEAL ADHESIVE. APPLY 5 INCH WIDE TAPE AT CORNERS, WELD PINS ON TOP, SIDES AND BOTTOM.

14. PIPING INSULATION

A. INSULATE ALL PIPING IN ACCORDANCE WITH INSULATION SCHEDULE ON M-600 DRAWING EXCEPT AS OTHERWISE NOTED.

B. PIPING, VALVES AND FITTINGS TO BE INSULATED:

i. LOW TEMPERATURE PIPING SYSTEMS, 40 TO 100°F INCLUDING

a) CHILLED WATER SUPPLY AND RETURN.

b) CONDENSER WATER SUPPLY AND RETURN.

c) GLYCOL WATER SUPPLY AND RETURN.

d) CONDENSATE DRAIN PIPING.

ii. LOW TEMPERATURE HOT PIPING SYSTEMS, 100 TO 250°F INCLUDING

a) LOW TEMPERATURE HOT WATER SUPPLY AND RETURN.

b) LOW PRESSURE STEAM SUPPLY TO 15 PSIG.

c) LOW PRESSURE CONDENSATE RETURN, EXCEPT STEAM TRAPS AND TRAP ASSEMBLY AND RADIATION RUNOUTS CONCEALED IN RADIATION ENCLOSURES.

d) PUMPED CONDENSATE DISCHARGE.

C. MATERIAL

i. TYPE P-1: MINIMUM 4 LB DENSITY MOLDED FIBERGLASS, MAXIMUM 0.23 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY-APPLIED FIRE-RETARDANT FOIL-SKRIM-KRAFT FACING. ALL SERVICE JACKET. SIMILAR TO OWENS-CORNING 650 ASJ.

ii. TYPE P-4: MINIMUM 1 LB DENSITY FIBERGLASS FITTING INSERTS, MAXIMUM 0.28 K-FACTOR AT 75°F MEAN TEMPERATURE SIMILAR TO MANVILLE HI-LO TEMP INSULATION INSERTS.

iii. TYPE P-6: MINIMUM 6 LB MOLDED FOAMED PLASTIC. MAXIMUM 0.27 K-FACTOR AT 75°F MEAN TEMPERATURE. MAXIMUM 0.17 PERMEANCE. SIMILAR TO ARMSTRONG ARMAFLEX II.

D. FINISH:

i. TYPE F-1: FITTING COVER, MOLDED WHITE PVC JACKET, UL CLASS 1, MAXIMUM PERMEANCE 0.05 SIMILAR TO MANVILLE ZESTRON.

ii. TYPE F-4: PVC JACKETING WITH MINIMUM 0.016 INCH WALL THICKNESS AND LONGITUDINAL JOINTS WITH LOCK SEAMS.

E. OUTDOOR PIPING:

i. FOR ALL PIPING, FITTINGS AND VALVES LOCATED OUTDOORS, INCREASE SCHEDULED INSULATION THICKNESS BY A MINIMUM OF 1 INCH AND PROVIDE F-4 FINISH. PROVIDE VAPORSEAL ON ALL OUTDOOR PIPES, VALVES AND FITTINGS SUBJECT TO CONDENSATION.

ii. COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL HEAT TRACING REQUIREMENTS AND PIPING LENGTH REQUIREMENTS. ELECTRICAL TO PROVIDE CABLING AND THERMOSTAT.

F. INSTALLATION:

i. BEFORE APPLYING INSULATION ALL PRESSURE AND LEAK TESTS SHALL BE COMPLETED AND APPROVED.

ii. ALL INSULATION SHALL BE BUTTED FIRMLY TOGETHER. PROVIDE 2 INCH LAMP STRIPS AT ALL SEAMS SECURED WITH ADHESIVE. USE VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE WHERE REQUIRED. STAPLES NOT PERMITTED. REFRIGERANT PIPING INSULATION SHALL HAVE MITERED FITTINGS.

iii. ALL INSULATION AND VAPOR BARRIERS SHALL BE CONTINUOUS PASSING THROUGH SLEEVES, HANGERS, ETC., OR OTHER OPENINGS. PROVIDE SADDLES OR SHIELDS FOR PROTECTION.

iv. INSULATION FOR STRAINERS OR OTHER FITTINGS OR ACCESSORIES REQUIRING SERVICING OR INSPECTION SHALL HAVE INSULATION REMOVABLE AND REPLACEABLE WITHOUT DAMAGE.

15. FIRE-RATED INSULATION SYSTEMS

A. FIRE-RATED BOARD: STRUCTURAL-GRADE, PRESS-MOLDED, XONOLITE CALCIUM SILICATE, FIREPROOFING BOARD SUITABLE FOR OPERATING TEMPERATURES UP TO 1700°F. COMPLY WITH ASTM C 656, TYPE II, GRADE 6. TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING BY A NRTL ACCEPTABLE TO AUTHORITY HAVING JURISDICTION. MANUFACTURERED BY JOHNS MANVILLE; SUPER FIRETEMP M.

B. FIRE-RATED BLANKET: HIGH-TEMPERATURE, FLEXIBLE, BLANKET INSULATION WITH FSK JACKET THAT IS TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING BY A NRTL ACCEPTABLE TO AUTHORITY HAVING JURISDICTION. MANUFACTURED BY JOHNS MANVILLE; FIRETEMP WRAP; FIREMASTER DUCT WRAP, 3M; FIRE BARRIER WRAP PRODUCTS, UNIFRAX CORPORATION; FYREWRAP.

C. NYC PROJECTS: PRODUCT SHALL HAVE LISTING FOR THE PARTICULAR APPLICATION

16. VIBRATION ISOLATION

A. FURNISH AND INSTALL ALL NECESSARY VIBRATION ISOLATORS, VIBRATION HANGERS, MOUNTING PADS, RAILS, ETC., TO ISOLATE VIBRATION AND SOUND FROM BEING TRANSMITTED TO THE BUILDING STRUCTURE. ALL VIBRATION PRODUCTS SHALL BE SPECIFICALLY DESIGNED FOR THEIR INTENDED USE. PROVIDE ISOLATION FOR MOTORIZED EQUIPMENT.

B. MANUFACTURER OF THE VIBRATION ISOLATION EQUIPMENT SHALL HAVE THE FOLLOWING RESPONSIBILITIES

i. SUBMIT TYPE, SIZE, DEFLECTION, LOCATION AND DETAILS INCLUDING FREE HEIGHT FOR EACH ISOLATOR PROPOSED FOR ITEMS IN THE SPECIFICATION AND

ON THE DRAWINGS.

ii. SUBMIT DETAILS OF ALL STEEL FRAMES AND CONCRETE INERTIA BASES TO BE USED IN CONJUNCTION WITH THE ISOLATION IN THIS SPECIFICATION AND IN THE DRAWINGS.

iii. CLEARLY OUTLINE THE PROCEDURES FOR INSTALLING AND ADJUSTING THE ISOLATORS OR HANGERS.

iv. GUARANTEE THE SPECIFIED ISOLATION SYSTEMS DEFLECTION AND THAT A MINIMUM OF 90% EFFICIENCY WILL BE OBTAINED.

C. THE FOLLOWING ARE APPROVED MANUFACTURERS, PROVIDED THEIR SYSTEMS STRICTLY COMPLY WITH THE DESIGN INTENT FOR PERFORMANCE, DEFLECTION AND STRUCTURAL CAPACITY OF THIS SPECIFICATION.
   I. MASON INDUSTRIES, INC., HAUPPAUGE, NY
   II. VIBRATION MOUNTINGS & CONTROLS, INC., BLOOMINGDALE, NJ
   III. AMBER BOOTH, HOUSTON, TX
   IV. KINETICS NOISE CONTROL, INC

D. PROVIDE INSTALLATION INSTRUCTIONS, DRAWINGS AND FIELD SUPERVISION TO ASSURE PROPER INSTALLATION AND PERFORMANCE.

E. INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS INCLUDING THE LOAD AND SPRING STATIC DEFLECTION FOR EACH FLOOR OR CEILING HUNG ISOLATOR.

F. PROVIDE LEVELING DEVICES AND APPROVED RESILIENT DEVICES AS REQUIRED TO LIMIT EQUIPMENT AND PIPING MOTION IN EXCESS OF 1/4 INCH ISOLATORS SHALL HAVE CAPABILITY OF SUPPORTING EQUIPMENT AND PIPING AT A FIXED ELEVATION DURING INSTALLATION AND AT A SPECIFIED HEIGHT AFTER ADJUSTMENT.

G. ALL SPRINGS SHALL HAVE AT LEAST 50% ADDITIONAL LOAD CAPACITY ABOVE DESIGN LOAD.

H. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE EQUIPMENT CANNOT SUPPORT POINT LOADS.

I. PROVIDE CORROSION PROTECTION FOR EQUIPMENT MOUNTED OUTDOORS. SPRING CORROSION RESISTANCE SHALL BE POWDER COATING OF THE SPRING WITH THE STEEL HOUSING HOT DIPPED GALVANIZED. ALL HARDWARE TO BE CADMIUM PLATED.

J. CENTRIFUGAL FANS

i. FLOOR MOUNTED AXIAL FANS, CABINET FANS, FAN SECTIONS, AIR HANDLING UNITS UTILIZE MASON TYPE SLF FREE STANDING SPRING OR EQUAL.

ii. CEILING HUNG UTILIZE MASON TYPE 30 N OR EQUAL.

iii. 3 HP AND LESS MOTOR TYPE B-1 BASE WITH SPRING ISOLATORS MASON TYPE SLF SPRING ISOLATORS OR EQUAL.

iv. 24 INCH DIAMETER AND UP, WITH UP TO 40 HP MOTOR-TYPE B-1 BASE WITH MASON TYPE SLF SPRING ISOLATORS OR EQUAL.

v. MOTOR SIZE - MINIMUM CONCRETE THICKNESS

a) 5 TO 15 HP - 6 INCHES

b) 20 TO 50 HP - 8 INCHES

K. FLOOR MOUNTING OF PACKAGED AIR CONDITIONING UNIT WITH INTERNAL ISOLATION FOR COMPRESSORS - NEOPRENE IN SHEAR - TYPE SUPER W- BRIDGE BEARING.

i. 50 PSI MAXIMUM LOADING. PROVIDE STEEL BEARING PLATE TO DISTRIBUTE LOAD WHERE REQUIRED.

L. ROOFTOP AC UNITS - SPRING ROOF CURB - TYPE RSC AND/OR DUNNAGE STEEL WITH TYPE SLR WITH VERTICAL LIMIT STOPS.

M. SUPPORT OF PIPING IN EQUIPMENT ROOMS AND WHERE EXPOSED ON ROOF

i. ALL WATER PIPING OUTSIDE OF SHAFTS WITHIN 50 FEET OF CONNECTED ROTATING EQUIPMENT TO BE SUPPLIED WITH ISOLATORS.

ii. HANGER ROD ISOLATORS (TYPE 30N) MOUNTINGS.

iii. INDOOR SUPPORTED PIPING ISOLATORS (TYPE SLR).

iv. VERTICAL RISER PIPING ANCHOR AND GUIDES (TYPE ADA).

N. FLOOR AND ROOF MOUNTING OF FACTORY ASSEMBLED AIR HANDLING UNITS, AIR CONDITIONING UNITS, HEAT EXCHANGERS AND CONDENSING UNITS, - SPRING ISOLATORS (ROOF MOUNTED EQUIPMENT TYPE SLR), OR (INDOOR EQUIPMENT TYPE SLF).

O. PROVIDE FLEXIBLE CONNECTIONS BETWEEN ALL FANS AND DUCTWORK (REFER TO DUCTWORK SECTION FOR SPECIFICATIONS).

17. PIPING - GENERAL REQUIREMENTS

A. COMPLETE WITH: PIPE, FITTINGS, VALVES, STRAINERS, MOTORIZED VALVE OPERATORS, HANGERS, SUPPORTS, GUIDE, SLEEVES, AND ACCESSORIES.

B. ALL ITEMS SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH THE LATEST EDITIONS OF THE FOLLOWING CODES AND STANDARDS:

i. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME).

ii. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).

iii. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).

iv. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (MSS).

C. GASKETS: ONE PIECE RING TYPE 1/16 INCH MINIMUM THICKNESS KLINGER C4400 ONLY (OR APPROVED EQUAL, SUBMIT FOR APPROVAL BEFORE USE).

D. WELDING

i. ALL WELDING SHALL BE DONE IN ACCORDANCE WITH ALL CODES APPLICABLE TO THE PARTICULAR SERVICE. 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.

ii. COMPLY WITH SECTION II, PART C OF THE ASME BOILER AND PRESSURE VESSEL CODE FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND FOR CHEMICAL ANALYSIS OF PIPE BEING WELDED.

iii. QUALIFY PROCESSES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX, “WELDING AND BRAZING QUALIFICATIONS”. COMPLY WITH PROVISIONS IN ASME B31 SERIES, "CODE FOR PRESSURE PIPING."

iv. WELDERS SHALL BE QUALIFIED FOR ALL REQUIRED PIPE SIZES, MATERIAL, WALL THICKNESS, AND POSITION IN ACCORDANCE WITH THE AMERICAN SOCIETY OF MECHANICAL ENGINEERING (ASME) SECTION IX, BOILER AND PRESSURE VESSEL CODE. CERTIFY THAT EACH WELDER HAS PASSED AWS QUALIFICATION TESTS FOR WELDING PROCESSES INVOLVED AND THAT CERTIFICATION IS CURRENT.

v. COPIES OF THE CERTIFIED WELDER QUALIFICATION REPORTS SHALL BE MAINTAINED BY THE RESPONSIBLE WELDING AGENCY AND THE COMPANY PERFORMING THE WELDING, AND SHALL BE SUBMITTED TO THE OWNER AND/OR ENGINEER UPON REQUEST.

vi. ALL DEFECTIVE WELDS SHALL BE CHIPPED OUT AND REPAIRED AT NO COST TO THE OWNER, BASED ON PROCEDURE TO BE SPECIFIED AT THE TIME.

E. COPPER TUBE BRAZING

i. ALL BRAZING SHALL BE DONE IN ACCORDANCE WITH ALL CODES APPLICABLE TO THE PARTICULAR SERVICE. BRAZING FILLER METALS: AWS A5.8, BCUP SERIES, COPPER-PHOSPHORUS ALLOYS FOR JOINING COPPER WITH COPPER; OR BAG-1, SILVER ALLOY FOR JOINING COPPER WITH BRONZE OR STEEL.

ii. QUALIFY PROCESS AND OPERATORS IN ACCORDANCE WITH ASME BOILER AND PRESSURE VESSEL CODE, SECTION IX, “WELDING AND BRAZING QUALIFICATIONS”.

iii. BRAZERS SHALL BE QUALIFIED FOR ALL REQUIRED TUBE SIZES, MATERIAL, WALL THICKNESS, AND POSITION IN ACCORDANCE WITH THE AMERICAN SOCIETY OF MECHANICAL ENGINEERING (ASME), SECTION IX, BOILER AND PRESSURE VESSEL CODE.

iv. COPIES OF THE CERTIFIED BRAZER QUALIFICATION REPORTS SHALL BE MAINTAINED BY THE RESPONSIBLE BRAZING AGENCY AND THE COMPANY PERFORMING THE BRAZING, AND SHALL BE SUBMITTED TO THE OWNER AND/OR ENGINEER UPON REQUEST.

v. ALL DEFECTIVE BRAZEMENTS SHALL BE CHIPPED OUT AND REPAIRED AT NO COST TO THE OWNER, BASED ON PROCEDURE TO BE SPECIFIED AT THE TIME.

F. GASKETS

i. PIPE-FLANGE GASKET MATERIALS: SUITABLE FOR CHEMICAL AND THERMAL CONDITIONS OF PIPING SYSTEM CONTENTS. ASME B16.21, NONMETALLIC, FLAT, ASBESTOS-FREE, 1/8-INCH MAXIMUM THICKNESS UNLESS THICKNESS OR SPECIFIC MATERIAL IS INDICATED.

G. ALL PRESSURIZED HYDRONIC PIPING TO BE TESTED HYDROSTATICALLY TO 150 PSI OR 150% OF OPERATING PRESSURE, WHICHEVER IS GREATER, BUT NEVER EXCEED TEST PRESSURE ANSI B16.1 BASIS. TEST DURATION TO BE 2 HOURS WITH NO PRESSURE CHANGE CORRECTED FOR TEMPERATURE CHANGE. REPAIR OR REPLACE LEAKS OR DEFECTS WITHOUT ADDITIONAL COST.

i. REFRIGERANT PIPING

a) TEST REFRIGERANT PIPING FOR TIGHTNESS AND LEAKS UNDER PRESSURE OR VACUUM - COORDINATE WITH MANUFACTURER REQUIREMENTS. THE DURATION OF EACH TEST SHALL BE TWENTY-FOUR (24) HOURS.

b) TEST JOINTS IN ACCORDANCE WITH ASHRAE 15-LATEST EDITION. THERE SHALL BE NO OBSERVABLE LEAKS OR CHANGES IN PRESSURE. IF EITHER IS OBSERVED, SEAL LEAKS, AND REPEAT TEST PROCEDURES

H. SYSTEM FILLING

i. SYSTEMS OR PORTIONS OF SYSTEMS TO BE TESTED SHALL HAVE PROVISIONS FOR FILLING, VENTING (AIR REMOVAL), DRAINAGE AND TEST PRESSURE CONNECTION.

ii. LIQUID USED FOR TESTING SHALL BE CLEAN CITY WATER MIXED WITH CHEMICALS SPECIFIED BY THE BASE BUILDING WATER TREATMENT CONTRACTOR. THE HVAC CONTRACTOR SHALL HIRE THE SERVICES OF THE BUILDING WATER TREATMENT CONTRACTOR AND PROVIDE ALL REQUIRED LABOR. PROVIDE TEMPORARY METERING AND MIXING DEVICES AS REQUIRED. THE HVAC CONTRACTOR SHALL OBTAIN ALL REQUIREMENTS FROM THE BUILDING MANAGEMENT.

I. FLUSHING AND CLEANING AND TREATMENT

i. AFTER COMPLETION OF HYDROSTATIC TESTS AND EMPTYING, PROVIDE LABOR FOR INITIAL FLUSHING, CLEANING, AND PASSIVATING IN ACCORDANCE WITH THE OWNER'S WATER TREATMENT SPECIFICATION. THE HVAC CONTRACTOR SHALL HIRE THE SERVICES OF THE BASE BUILDING WATER TREATMENT CONTRACTOR. COORDINATE WITH THE OWNER'S WATER TREATMENT COMPANY AND PROVIDE ALL SPECIFICATION REQUIREMENTS AND REQUIRED LABOR. COORDINATE ALL REQUIREMENTS WITH BASE BUILDING MANAGEMENT FOR BASE BUILDING VENDOR.

ii. PROVIDE ONE YEAR'S SUPPLY OF NECESSARY WATER TREATMENT CHEMICALS FOR NEW SYSTEM TO THE OWNER OR TENANT INCLUDING THE FOLLOWING:

iii. CLOSED SYSTEM TREATMENT (CHILLED WATER, SECONDARY WATER, CLOSED CONDENSER WATER AND HOT WATER). PROVIDE AGENTS TO REDUCE SCALE DEPOSITS, TO ADJUST PH AND TO INHIBIT CORROSION. TREATMENT SHALL NOT CONTAIN ANY CHROMATE'S OR OTHER TOXIC SUBSTANCES. USE PROPER CHEMISTRY TO PROVIDE BACTERIA COUNTS BELOW 10^3 COLONIES PER MILLILITER (AEROBIC & NON AEROBIC). PH LEVELS TO BE BETWEEN 7.0 AND 9.0. CORROSION RATE TO BE LESS THAN 1/2 MILS/YEAR STEEL, 1/10 MILS/YEAR COPPER.

iv. OPEN SYSTEM TREATMENT (CONDENSER WATER) PROVIDE AGENTS TO REDUCE SCALE DEPOSITS, TO ADJUST PH AND TO INHIBIT CORROSION. TREATMENT SHALL NOT CONTAIN ANY CHROMATE'S OR OTHER TOXIC SUBSTANCES. USE PROPER CHEMISTRY TO PROVIDE BACTERIA COUNTS BELOW 10^5 COLONIES PER MILLIMETER (AEROBIC AND NON-AEROBIC). PH TO BE BETWEEN 7.5 AND 8.5. CORROSION RATES TO BE LESS THAN 1 MILS/YEAR -STEEL AND 1/10 MILS/YEAR COPPER.

J. PROVIDE DIELECTRIC FITTINGS WHERE DISSIMILAR METALS ARE TO BE JOINED.

K. HOT (WET) TAPS:

i. PROVIDE NEW HOT (WET) TAP CONNECTIONS INTO PIPING SYSTEMS AS INDICATED ON THE PLANS.

ii. PROVIDE ALL REQUIRED EQUIPMENT AND MATERIALS SUCH AS A TAPPING MACHINE, WELDING MACHINE, FULL PORTED VALVE AND A PRESSURE

CONTAINING FITTING. VALVE AND PRESSURE FITTING TO BE RATED FOR THE WORKING PRESSURE OF THE PIPING SYSTEM.

iii. HOT TAP TO BE PERFORMED BY A QUALIFIED CONTRACTOR WHO IS SPECIALIZED IN PERFORMING THIS TYPE OF WORK. CONTRACTORS NAME SHALL BE SUBMITTED TO THE OWNER, OWNER'S REPRESENTATIVE, BUILDING MANAGEMENT AND ENGINEER FOR APPROVAL PRIOR TO COMMENCING WORK.

iv. HOT (WET) TAP COUPON IS TO BE TURNED OVER TO BUILDING MANAGEMENT.

L. DRAIN DOWN FOR NEW PIPING CONNECTION INTO EXISTING:

i. CONTRACTOR TO OBTAIN SCHEDULE AND COORDINATE WITH BUILDING MANAGEMENT FOR SYSTEM DRAIN DOWN AND CONNECTION INTO EXISTING BUILDING PIPING. ALL COSTS ASSOCIATED WITH DRAIN DOWN ARE TO BE INCLUDED AS PART OF BID.

M. ALL INSTRUMENTATION (PRESSURE GAUGES AND THERMOMETERS) SHALL BE RATED FOR THE SAME PRESSURE AND TEMPERATURE AS PIPING SYSTEM AND RATED SPECIFICALLY FOR THE SAME SERVICE AS THE PIPING. PRESSURE GAUGES ARE TO BE LIQUID FILLED WITH 1% ACCURACY. SELECT GAUGES AND THERMOMETERS SO THAT THE MID-POINT IS AT THE WORKING PRESSURE AND TEMPERATURE. INSTRUMENTS TO BE MANUFACTURED BY WEISS INSTRUMENT, MILJOCO CORPORATION OR APPROVED EQUAL.

i. PROVIDE THERMOMETERS IN PIPING AS INDICATED ON THE DRAWINGS AND AT THE INLET AND OUTLET OF EACH HYDRONIC COIL, HEAT EXCHANGER AND PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL TEMPERATURE. THERMOMETERS TO BE ORGANIC LIQUID FILLED.

ii. PROVIDE PRESSURE GAUGES IN PIPING AS INDICATED ON THE DRAWINGS AND AT SUCTION AND DISCHARGE OF EACH PUMP AND AT INLETS AND OUTLETS OF EACH HYDRONIC COIL, HEAT EXCHANGER AND PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL PRESSURE.

N. PIPE SUPPORTS:

i. PROVIDE ADEQUATE SUPPORT FOR PIPE AND CONTENTS TO PREVENT SAGGING, VIBRATION, OR SWAYING AND ALLOW FOR EXPANSION AND CONTRACTION. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE STRUCTURE CANNOT SUPPORT POINT LOADS.

ii. HORIZONTAL PIPING TO BE SUPPORTED BY FORGED STEEL ADJUSTABLE CLEVIS TYPE HANGER. MAXIMUM SPACING AS FOLLOWS:

a) STEEL 1 INCH AND SMALLER: 6 FEET.

b) STEEL 1-1/4 INCH AND LARGER: 10 FEET.

c) COPPER 1 INCH AND SMALLER: 5 FEET.

d) COPPER 1-1/2 IN to 2-1/2 INCH: 8 FEET.

e) COPPER 3 INCH: 10 FEET.

f) PROVIDE ADDITIONAL SUPPORTS AT CHANGES IN DIRECTION, BRANCH PIPING AND RUNOUTS OVER 5 FEET AND CONCENTRATE LOADS DUE TO VALVES, STRAINERS AND OTHER SIMILAR ITEMS.

iii. ROD SIZE

a) PIPE 2 IN AND SMALLER: 3/8 IN

b) PIPE 2-1/2 IN TO 3 IN: 1/2 IN

c) PIPE 4 TO 8 IN: 3/4 IN

iv. VERTICAL PIPING:

a) BASE ELBOW SUPPORT WITH BEARING PLATE ON STRUCTURAL SUPPORT.

b) GUIDES AT EVERY SECOND FLOOR (SPACING NOT TO EXCEED 25 FEET).

c) TOP SUPPORT HANGER OR SADDLE IN HORIZONTAL CONNECTION WITH PROVISIONS FOR EXPANSION.

d) INTERMEDIATE STEEL RISER CLAMP SUPPORT BOLTED AND WELDED TO PIPE BEARING ON STRUCTURAL STEEL OR BEARING PLATE AT FLOOR.

e) FOR MULTIPLE PIPES, COORDINATE GUIDES, BEARING PLATES AND ACCESSORY STEEL.

O. VALVES - GENERAL REQUIREMENTS

i. VALVE PRESSURE AND TEMPERATURE RATINGS: NOT LESS THAN INDICATED AND AS REQUIRED FOR SYSTEM PRESSURES AND TEMPERATURES.

ii. VALVE SIZES: SAME AS UPSTREAM PIPING UNLESS OTHERWISE INDICATED.

iii. VALVE-END CONNECTIONS:

a) FLANGED: WITH FLANGES ACCORDING TO ASME B16.1 FOR IRON VALVES

b) FLANGED: WITH FLANGES ACCORDING TO ASME B16.5 FOR STEEL VALVES

c) FLANGED: WITH FLANGES ACCORDING TO ASME B16.24 FOR BRONZE VALVES.

d) SOLDER JOINT: WITH SOCKETS ACCORDING TO ASME B16.18.

e) THREADED: WITH THREADS ACCORDING TO ASME B1.20.1.

f) VALVE BYPASS AND DRAIN CONNECTIONS: MSS SP-45.

iv. GENERAL-DUTY VALVE APPLICATIONS: UNLESS OTHERWISE INDICATED, USE THE FOLLOWING VALVE TYPES:

a) SHUTOFF SERVICE EXCEPT STEAM: BALL, BUTTERFLY OR GATE VALVES.

b) SHUTOFF SERVICE, STEAM: GATE VALVES.

c) THROTTLING SERVICE EXCEPT STEAM: BALL, BUTTERFLY, PLUG VALVES.

d) THROTTLING SERVICE, STEAM: GLOBE VALVES.

v. INSTALL SHUTOFF DUTY VALVES AT EACH BRANCH CONNECTION TO SUPPLY MAINS, AT SUPPLY CONNECTION TO EACH PIECE OF EQUIPMENT, UNLESS ONLY ONE PIECE OF EQUIPMENT IS CONNECTED IN THE BRANCH LINE. INSTALL THROTTLING DUTY VALVES AT EACH BRANCH CONNECTION TO RETURN MAINS, AT RETURN CONNECTIONS TO EACH PIECE OF EQUIPMENT, AND ELSEWHERE AS INDICATED.

vi. INSTALL CALIBRATED BALANCING VALVES IN THE RETURN WATER LINE OF EACH HEATING OR COOLING ELEMENT AND ELSEWHERE AS REQUIRED TO FACILITATE SYSTEM BALANCING.

vii. INSTALL SPRING LOADED CHECK VALVES AT EACH PUMP DISCHARGE AND ELSEWHERE AS REQUIRED TO CONTROL FLOW DIRECTION.

viii. THREADED CONNECTIONS ARE NOT TO BE USED FOR GLYCOL SYSTEMS.

18. REFRIGERANT SYSTEMS

A. PROVIDE ALL REFRIGERANT PIPING REQUIRED FOR A COMPLETE REFRIGERATION SYSTEM, WITH ALL VALVES, FITTINGS AND SPECIALTIES NECESSARY FOR SATISFACTORY OPERATION IN ACCORDANCE WITH ASHRAE STANDARD 15-LATEST EDITION AND ALL AUTHORITIES HAVING JURISDICTION. REFRIGERATION SYSTEM SHALL INCLUDE ALL REQUIRED ITEMS FOR CHARGING, DRAINING AND PURGING THE SYSTEM.

B. REFRIGERANT PIPING SHALL BE HARD COOPER, TYPE L OR ACR, ASTM B88 OR ASTM B

280, BRAZED.

C. JOINTS IN REFRIGERATION PIPING SHALL BE BRAZED.

D. REFRIGERANT PIPING SHALL BE OF THE SIZE AND NUMBER OF PIPES RECOMMENDED BY THE MANUFACTURER AND AS APPROVED BY THE ENGINEER.

E. HORIZONTAL PIPING OF THE COMPRESSOR SUCTION AND DISCHARGE LINES AND THE CONDENSER DISCHARGE LINES SHALL BE PITCHED A MINIMUM OF ½ INCH IN 10 FEET, IN THE DIRECTION OF REFRIGERANT FLOW. EACH SUCTION GAS VERTICAL RISER SHALL BE TRAPPED AT ITS EVAPORATOR WITH A TRAP AS RECOMMENDED BY THE COMPRESSOR MANUFACTURER.

F. INSTALL REFRIGERANT PIPING TO PREVENT EXCESSIVE OIL FROM BEING TRAPPED IN THE SYSTEM. ANY ADDITIONAL RISERS OR EQUALIZER LINES REQUIRED BY THE MANUFACTURER OF EQUIPMENT FOR THE PROPER SYSTEM OPERATION SHALL BE INSTALLED AS PART OF THIS CONTRACT. PROVIDE A FULLY PIPED OIL SEPARATOR FOR EACH REFRIGERANT SYSTEM AS PER MANUFACTURER'S RECOMMENDATIONS.

G. VALVES SHALL BE DESIGNED FOR REFRIGERANT SERVICE. SHUTOFF VALVES SHALL BE BRASS PACKLESS TYPE. UNIONS, FLANGED VALVES OR FITTINGS SHALL BE PROVIDED FOR DISCONNECTING EQUIPMENT, CONTROLS, ETC. FOR MAKING REPAIRS. PIPING SHALL BE RUN IN A SINGLE LAYER, WITH EACH LINE ISOLATED FROM ANOTHER TO PREVENT RUBBING. PROVISION SHALL BE MADE FOR EXPANSION AND CONTRACTION OF PIPING. ALL PIPING PASSING THROUGH WALLS, PARTITIONS, ETC., SHALL BE FURNISHED WITH SLEEVES AS REQUIRED.

H. REFRIGERANT PIPING PASSING THROUGH RATED FLOORS OR DEMISING WALLS SHALL BE ENCLOSED IN A RIGID AND GAS-TIGHT CONTINUOUS FIRE-RESISTING PIPE DUCT OR SHAFT VENTED TO THE OUTSIDE, IN ACCORDANCE WITH ASHRAE STANDARD 15-LATEST EDITION. PIPE CONDUIT SHALL BE COPPER TUBE TYPE L WITH SOLDERED FITTINGS.

I. REFRIGERANT PIPING RUNNING THROUGH/ABOVE PUBLIC CORRIDORS SHALL BE INSTALLED WITHIN 1-HR RATED ENCLOSURE. UNLESS IT CONTAINS LESS THAN 10 POUNDS OF GROUP A-1 REFRIGERANT, ITS COMPLETE DISCHARGE INTO THE CORRIDOR WOULD BE LESS THAN 50% OF ITS RCL PER TABLE 1103.1 IN THE NYC AND IT IS INSTALLED AT LEAST 9' AFF.

J. SHAFTS CONTAINING REFRIGERANT PIPING SHALL NOT BE SHARED WITH ANY AIR DUCTWORK.

19. ELECTRICAL WORK

A. GENERAL:

i. ELECTRICAL POWER WIRING SHALL BE PROVIDED BY THE ELECTRICAL CONTRACT. CONTROL WIRING SHALL BE PROVIDED BY THE HVAC CONTRACT. CONTROL WIRING SHALL BE DEFINED AS ANY WIRING 120V AND BELOW

INSTALLED FOR PURPOSES OTHER THAN PROVIDING PRIMARY ELECTRICAL POWER TO EQUIPMENT.

ii. MOTOR STARTERS AND VARIABLE FREQUENCY DRIVES (VFD) SHALL BE FURNISHED BY THE HVAC CONTRACTOR AND INSTALLED BY THE ELECTRICAL CONTRACTOR. REFER TO EQUIPMENT SECTION FOR VARIABLE FREQUENCY DRIVE SPECIFICATIONS.

iii. DUCT MOUNTED SMOKE DETECTORS, WHERE REQUIRED, SHALL BE PROVIDED BY AND WIRED BY THE ELECTRICAL CONTRACTOR, AND MOUNTED BY THE HVAC CONTRACTOR.

a) THIS CONTRACTOR SHALL INSTALL THE SMOKE DETECTOR SAMPLING TUBES IN THE DUCT AS COORDINATED IN THE FIELD.

b) THIS CONTRACTOR SHALL ASSIST THE ELECTRICAL CONTRACTOR IN TESTING THE DUCT-MOUNTED SMOKE DETECTION SYSTEM.

iv. ALL ELECTRICAL CONTROL WIRING SHALL COMPLY WITH LOCAL ELECTRICAL CODE, ALL AUTHORITIES HAVING JURISDICTION AND THE PROJECT ELECTRICAL SPECIFICATIONS.

v. MECHANICAL CONTRACTOR TO OBTAIN QUANTITY OF CONTROLLERS REQUIRED AND COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL OPERATING REQUIREMENTS, INTERLOCKS AND CONNECTIONS FOR STARTERS.

vi. THE MECHANICAL CONTRACTOR SHALL PREPARE AND SUBMIT FOR APPROVAL POINT TO POINT, COMPLETELY COORDINATED WIRING DIAGRAMS AND INDICATE ALL SOURCE POWER REQUIREMENTS AND ALL FIELD WIRING TO BE PERFORMED BY THE ELECTRICAL CONTRACTOR.

vii. WHERE EXISTING STARTERS ARE TO BE REUSED, THIS CONTRACTOR SHALL MAINTAIN ALL EXISTING CONTROL CONNECTIONS. WHERE NEW STARTERS ARE TO BE PROVIDED TO REPLACE EXISTING, THIS CONTRACTOR SHALL SURVEY THE EXISTING CONTROL CONNECTIONS AND PREPARE AN EXISTING CONTROL WIRING DIAGRAM PRIOR TO DEMOLITION FOR SUBMITTAL TO THE ENGINEER. THE NEW STARTERS SHALL BE PROVIDED WITH THE NECESSARY CONTACTS AND RELAYS REQUIRED TO RECONNECT THE EXISTING CONTROLS. PROVIDE ALL REQUIRED CONTACTS FOR START/STOP AND FIRE ALARM.

20. MOTORS:

A. MOTORS SHALL HAVE THE ELECTRICAL CHARACTERISTICS AS LISTED ON THE DRAWINGS. COORDINATE ALL REQUIREMENTS WITH ELECTRICAL CONTRACTOR. ALL MOTORS SHALL COMPLY WITH NEMA MG-1 STANDARD AND SHALL BE OF THE HIGH EFFICIENCY TYPE AND MEET THE 1992 EPA ENERGY EFFICIENCY ACT AND UTILITY COMPANY REBATE REQUIREMENTS.

B. MOTORS FOR VARIABLE FREQUENCY DRIVES (VFD) SHALL BE SUITABLE FOR USE WITH VARIABLE FREQUENCY DRIVES AND COMPLY WITH NEMA MG-1 PART 31.40.4.2. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL REQUIREMENTS OF THE MOTOR AND VFD MANUFACTURER.

C. IF CONTRACTOR ELECTS TO SUBSTITUTE OR INCREASE MOTOR HORSEPOWER OVER THAT SPECIFIED, THE COST OF MOTOR AND ELECTRICAL CHANGES SHALL BE BORNE BY THIS CONTRACTOR.

D. MOTORS (UNDER HVAC WORK): IN ACCORDANCE WITH NEMA, IEEE AND ANSI C50 STANDARDS:

i. STANDARD EFFICIENCY UNLESS OTHERWISE NOTED.

ii. 1.15 SERVICE FACTOR INCLUDING MOTORS SERVED FROM A VFD

iii. SQUIRREL CAGE INDUCTION, OPEN DRIPPROOF TYPE, 1750 RPM, NEMA TYPE B INSULATION CLASS, CONTINUOUS DUTY, EXCEPT AS NOTED.

21. MOTOR CONTROLLERS

A. SUPPLIED BY HVAC CONTRACTOR AND INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR.

B. ENCLOSURES:

i. PROVIDE ENCLOSURES FOR STARTERS AND VFD'S SUITABLE FOR OPERATING ENVIRONMENT. ENCLOSURE'S SHALL BE NEMA 1 VENTILATED SHEETMETAL FOR INDOOR APPLICATION, NEMA 3R WITH ADDITIONAL GASKETING WEATHER-PROOF RAINTIGHT ENCLOSURE FOR EXPOSED OUTDOOR SERVICE OR INDOOR SERVICE EXPOSED TO MOISTURE. PROVIDE DISCONNECT SWITCH ON ENCLOSURE AS REQUIRED FOR SERVICE.

C. WITH SOLID-STATE (ELECTRONIC) OVERLOAD PROTECTION. COORDINATE ALL MOTOR CONTROLLER TYPES AND SIZES WITH MOTOR TYPES AND SIZES.

D. 1/3 HP AND SMALLER: PROVIDE MANUAL STARTER EXCEPT USE MAGNETIC TYPE WHERE AUTOMATICALLY CONTROLLED.

i. MANUAL TYPE: 2-POLE TOGGLE SWITCH WITH OVERLOAD PROTECTION AND PILOT LIGHT.

E. 1/2 HP AND LARGER: PROVIDE MAGNETIC STARTER:

i. COMBINATION UNFUSED DISCONNECT SWITCH AND MAGNETIC STARTER EXCEPT AS NOTED.

ii. SOLID-STATE (ELECTRONIC) OVERLOAD PROTECTION IN EACH PHASE LEG WITH

RESET IN ENCLOSURE.

iii. HOA SELECTOR SWITCH FOR AUTOMATICALLY OPERATED MOTORS. SAFETY CONTROLS COMMON TO BOTH CONTROLS.

iv. RED, GREEN AND AMBER PILOT LIGHTS.

v. SWITCHES: HORSE-POWER-RATED, EXTERNAL PADLOCKING TYPE.

vi. HOLDING COILS: 10 WATT, 120 VOLT.

vii. CONTACTS: MAIN LINE AND MINIMUM (2) - NORMALLY OPEN, (2) - NORMALLY CLOSED 10 AMP AUXILIARIES, IN ADDITION TO CONTACTS

viii. REQUIRED FOR CONTROLS SPECIFIED.

ix. CONTROL TRANSFORMER: FOR MOTORS OVER 120 VOLTS, TO STEP DOWN CONTROL VOLTAGE TO 120 VOLTS; OF THE REQUIRED CAPACITY WITH FUSE AND GROUND CONNECTION ON VOLTAGE SIDE.

x. FUSES: SIMILAR TO BUSSMAN.

xi. RELAYS: TO SUPPLEMENT AUXILIARY CONTACTS IN CONTROLLER. MINIMUM 10 WATT COIL AND TWO 10 AMP CONTACTS.

xii. TERMINALS: SUITABLE FOR CONDUCTORS NOTED AND AS APPROVED.

F. DISCONNECT SWITCHES ARE PROVIDED BY THE ELECTRICAL CONTRACTOR IF NOT INTEGRAL WITH EQUIPMENT.

G. ACCEPTABLE MANUFACTURERS:

i. EATON/ CUTLER HAMMER.

ii. SQUARE D.

iii. ALLEN BRADLEY.

iv. ABB

22. EQUIPMENT

A. PROVIDE ALL EQUIPMENT AND ACCESSORIES OF THE SIZES AND CAPACITIES AS SCHEDULED AND AS INDICATED ON THE DRAWINGS.

B. INSTALL EQUIPMENT IN ACCORDANCE WITH APPROVED SHOP DRAWINGS, MANUFACTURERS INSTRUCTIONS AND ALL CODES AND REGULATIONS WHICH APPLY.

C. PROVIDE EQUIPMENT SUPPORTS AND/OR MOUNTINGS AS INDICATED ON THE DRAWING, IN VIBRATION SPECIFICATION AND AS FOLLOWS:

i. FLOOR MOUNTED EQUIPMENT - PROVIDE DIMENSIONS FOR A 4 INCH CONCRETE HOUSEKEEPING PAD WITH ALL REQUIRED WATERPROOFING TO THE CONSTRUCTION MANAGER.

ii. EQUIPMENT ON FLOOR STANDS - PROVIDE FLOOR STAND OF STRUCTURAL STEEL OR STEEL PIPES AND FITTINGS ATTACHED TO FLOOR.

iii. ROOF MOUNTED EQUIPMENT - PROVIDE PREFABRICATED ISOLATED ROOF CURB WITH INTEGRAL VIBRATION ISOLATORS.

iv. CEILING MOUNTED EQUIPMENT - PROVIDE SUPPORTS WITH APPROVED SUITABLE ANCHORS SUSPENDED DIRECTLY FROM BUILDING STEEL STRUCTURE.

v. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED TO ADEQUATELY SUPPORT THE EQUIPMENT LOAD.

vi. EQUIPMENT SHALL BE INSTALLED WITH VIBRATION ISOLATION, REFER TO VIBRATION ISOLATION SECTION.

D. RIGGING

i. THIS CONTRACTOR SHALL SURVEY THE BUILDING AND VERIFY THE RIG PATH PRIOR TO PURCHASE OF EQUIPMENT. CONFIRM ALL EQUIPMENT FITS THROUGH ALL HALLWAYS, DOORS, ELEVATORS, WINDOWS, ETC. WITHOUT REQUIRING MAJOR ALTERATIONS TO THE EXISTING BUILDING CONDITIONS. ANY MODIFICATIONS TO EXISTING CONDITIONS SHALL BE REPAIRED OR REPLACED BY CONTRACTOR.

ii. THIS CONTRACTOR SHALL PROVIDE ALL REQUIRED RIGGING, HOISTING AND BRACING TO INSTALL THE EQUIPMENT AS INDICATED ON THE PLANS. THIS WORK SHALL BE PERFORMED BY AN INSURED CERTIFIED LICENSED RIGGING COMPANY THAT IS EXPERIENCED IN RIGGING EQUIPMENT OF THE TYPE INDICATED FOR THE AREAS SHOWN ON THE CONSTRUCTION DOCUMENTS. THIS CONTRACTOR SHALL SUBMIT RIGGING PLANS FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK.

iii. ALL PERMITS REQUIRED FROM THE AUTHORITIES AND AGENCIES INVOLVED TO PERFORM THE RIGGING ARE THE RESPONSIBILITIES OF THIS CONTRACTOR.

iv. ALL STRUCTURAL SUPPORTS, MODIFICATIONS OR ADDITIONS ARE TO BE SUBMITTED TO THE STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK. ALL SUPPLEMENTAL STRUCTURAL SUPPORTS, ELEVATOR CHARGES /MODIFICATIONS, BRACING AND PROTECTION REQUIRED FOR THE RIG IS THE RESPONSIBILITY OF THIS CONTRACTOR.

v. THE RIGGING CONTRACTOR SHALL HIRE AND PAY FOR ALL CHARGES AND SERVICES OF THE BUILDING ELEVATOR CONTRACTOR FOR THE RIGGING OF THE EQUIPMENT.

E. UP FRONT PURCHASE OF EQUIPMENT

i. THE CONTRACTOR SHALL SUBMIT A LIST OF LONG LEAD TIME ITEMS THAT WILL AFFECT THE SCHEDULE OF THE PROJECT IF NOT PURCHASED IMMEDIATELY UP FRONT AT THE START OF THE PROJECT. THE MECHANICAL CONTRACTOR SHALL SUBMIT PROPOSED MANUFACTURER AND LEAD TIMES FOR ALL PROJECT EQUIPMENT AT TIME OF PROJECT AWARD.

23. AUTOMATIC CONTROLS - GENERAL REQUIREMENTS

A. WORK INCLUDED

i. FURNISH AND INSTALL AS HEREIN SPECIFIED, A COMPLETE AUTOMATIC TEMPERATURE CONTROL SYSTEM. MANUFACTURER SHALL BE SUBMITTED WITH BID AND APPROVED BY ENGINEER BEFORE BID AWARD. THE ATC CONTRACTOR SHALL BE AN INDEPENDENT CONTRACTOR NOT AFFILIATED WITH THE MECHANICAL CONTRACTOR.

ii. PROVIDE POWER FOR PANELS AND CONTROL DEVICES FROM A SOURCE DESIGNATED BY THE ELECTRICAL CONTRACTOR.

iii. COORDINATE INSTALLATION SCHEDULE WITH THE MECHANICAL CONTRACTOR AND GENERAL CONTRACTOR.

iv. FURNISH, MOUNT, AND WIRE ALL ASSOCIATED PANELS AND DEVICES FOR THE SYSTEM TO BE COMPLETELY OPERATIONAL REGARDLESS OF FUNCTION OR VOLTAGE, UNLESS OTHERWISE STATED.

B. SUBMITTALS

i. PRODUCT DATA: INCLUDE MANUFACTURER'S TECHNICAL LITERATURE FOR EACH CONTROL DEVICE INDICATED, LABELED WITH SETTING OR ADJUSTABLE RANGE OF CONTROL. INDICATE DIMENSIONS, CAPACITIES, PERFORMANCE CHARACTERISTICS, ELECTRICAL CHARACTERISTICS, FINISHES FOR MATERIALS, AND INSTALLATION AND STARTUP INSTRUCTIONS FOR EACH TYPE OF PRODUCT INDICATED.

ii. 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.

a) SCHEMATIC FLOW DIAGRAMS SHOWING FANS, COILS, DAMPERS, VALVES, AND CONTROL DEVICES.

b) WIRING DIAGRAMS: POWER, SIGNAL, AND CONTROL WIRING.

c) DETAILS OF CONTROL PANEL FACES, INCLUDING CONTROLS, INSTRUMENTS, AND LABELING.

C. QUALITY ASSURANCE

i. INSTALLER QUALIFICATIONS: A QUALIFIED INSTALLER WHO IS AN AUTHORIZED REPRESENTATIVE OF THE AUTOMATIC CONTROL SYSTEM MANUFACTURER FOR BOTH INSTALLATION AND MAINTENANCE OF UNITS REQUIRED FOR THIS PROJECT.

ii. COMPLY WITH ALL CURRENT GOVERNING CODES, ORDINANCES, AND REGULATIONS INCLUDING UL, NFPA, THE LOCAL BUILDING CODE, NEC, ETC.

iii. MATERIALS AND EQUIPMENT SHALL BE THE CATALOGUED PRODUCTS OF MANUFACTURERS REGULARLY ENGAGED IN PRODUCTION AND INSTALLATION OF AUTOMATIC TEMPERATURE CONTROL SYSTEMS AND SHALL BE MANUFACTURER'S LATEST STANDARD DESIGN THAT COMPLIES WITH THE SPECIFICATION REQUIREMENTS.

24. SEQUENCE OF OPERATIONS:

A. SPLIT SYSTEM (VRF) SEQUENCE:

1) PROVIDE A 7-DAY PROGRAMMABLE THERMOSTAT (BY VRF MANUFACTURER) FOR EACH AIR HANDLER, WITH CAPABILITY FOR FAN TO BE ALWAYS ON OR IN AUTOMATIC MODE.

a) PROGRAMMABLE THERMOSTAT SHALL BE CAPABLE OF SETBACK CONTROLS, PROGRAMMED BY THE END USER, FOR 65°F AND 80°F IN WINTER AND SUMMER, RESPECTIVELY.

b) PROGRAMMABLE THERMOSTAT SHALL HAVE 5°F DEADBAND AND SETPOINT OVERLAP RESTRICTIONS

c) ALL UNITS TO BE CONNECTED TO CENTRALIZED CONTROLLER FOR MONITORING AND CONTROL.

2) PROVIDE ALL WIRING FROM CONDENSING UNITS TO RESPECTIVE AIR HANDLERS AND CENTRAL CONTROLLER.

3) FAN MODES:

IN ON MODE, FAN SHALL RUN CONTINUOUSLY. WHEN THE FAN STOPS, EACH ASSOCIATED MOTORIZED DAMPER SHALL CLOSE.

IN AUTOMATIC MODE, FAN SHALL ONLY ENERGIZE UPON A CALL FOR

COOLING/HEATING.

4) UNIT MODES:

a) IN COOLING MODE, THE CONDENSER SHALL CYCLE (ON, OFF) TO MAINTAIN SETPOINT.

b) IN HEATING MODE, THE HEAT PUMP SHALL CYCLE (ON, OFF) TO MAINTAIN SETPOINT.

c) FOR UNITS SERVING SPACES WITH EXTERIOR DOORS: DOOR SWITCH SHALL TEMPORARILY SHUT DOWN RESPECTIVE AHU WHEN DOOR IS OPEN FOR MORE THAN 5 MINUTES. UPON DOOR CLOSING, SYSTEM SHALL RE-ENERGIZE.

d) FOR AHUS SERVING AMENITY SPACES, ASSOCIATED THERMOSTATS SHALL DEFAULT TO SETBACK TEMPERATURES DURING UNOCCUPIED HOURS.

B. TOILET EXHAUST FANS:

I. FAN SHALL BE CONTROLLED VIA A WALL MOUNTED SWITCH.

Essex County Farmworker Renovation
MECHANICAL SPECIFICATIONS: FIREHOUSE

1. GENERAL

A. THE "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION," AIA DOCUMENT A201, LATEST EDITION, AND THESE SPECIFICATIONS AS APPLICABLE ARE PART OF THIS CONTRACT.

B. ALL APPLICABLE CODES, LAWS AND REGULATIONS GOVERNING OR RELATING TO ANY PORTION OF THIS WORK ARE HEREBY INCORPORATED INTO AND MADE A PART OF THESE SPECIFICATIONS, AND THEIR PROVISIONS SHALL BE CARRIED OUT BY THE CONTRACTOR WHO SHALL INFORM THE OWNER, PRIOR TO SUBMITTING A PROPOSAL, OF ANY WORK OR MATERIALS WHICH VIOLATE ANY OF THE ABOVE LAWS AND REGULATIONS. ANY WORK DONE BY THE CONTRACTOR CAUSING SUCH VIOLATION SHALL BE CORRECTED BY THE CONTRACTOR.

C. INVESTIGATE EACH SPACE THROUGH WITCH EQUIPMENT MUST BE MOVED INCLUDING HALLWAYS, DOOR WIDTHS, ELEVATOR DIMENSIONS, ETC. WHERE NECESSARY, EQUIPMENT SHALL BE SHIPPED FROM MANUFACTURER IN SECTIONS OF SIZE SUITABLE FOR MOVING THROUGH AVAILABLE RESTRICTIVE SPACES. ASCERTAIN FROM BUILDING OWNER AT WHAT TIMES OF DAY EQUIPMENT MAY BE MOVED THROUGH ALL AREAS.

D. DUCTWORK AND PIPING IS SHOWN DIAGRAMMATICALLY AND DOES NOT SHOW ALL OFFSETS, DROPS AND RISES OF RUNS. THE CONTRACTOR SHALL ALLOW IN HIS PRICE FOR ROUTING OF DUCTWORK AND PIPING TO AVOID OBSTRUCTIONS. EXACT LOCATIONS ARE SUBJECT TO APPROVAL OF ARCHITECT. COORDINATION WITH THE EXISTING SERVICES, INCLUDING THOSE OF OTHER TRADES IS REQUIRED.

E. SUPPORT ALL DUCTWORK AND PIPING FROM BUILDING STRUCTURE AND/OR FRAMING IN AN APPROVED MANNER. WHERE OVERHEAD CONSTRUCTION DOES NOT PERMIT FASTENING OR SUPPORTS FOR EQUIPMENT, FURNISH ADDITIONAL FRAMING. INSERTS SHALL BE STEEL, SLOTTED TYPE AND FACTORY PAINTED. SINGLE ROD SHALL BE SIMILAR TO GRINNELL FIG. 281. MULTI-ROD SHALL BE SIMILAR TO FEE & MASON SERIES 9000 WITH END CAPS AND CLOSURE STRIPS. MAXIMUM LOADING INCLUDING PIPES, DUCTWORK CONTENTS AND COVERING SHALL NOT EXCEED 75% OF RATED INSERT CAPABILITY. WHEN SUPPORTING FROM BUILDING USE BEAM CLAMPS IN APPROVED MANNER.

F. INSTALL WORK SO AS TO BE READILY ACCESSIBLE FOR OPERATION, MAINTENANCE AND REPAIR. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ACCOMPLISH THIS, BUT CHANGES WHICH INVOLVE EXTRA COST SHALL NOT BE MADE WITHOUT APPROVAL.

G. REMOVAL AND RELOCATION OF CERTAIN EXISTING WORK WILL BE NECESSARY FOR THE PERFORMANCE OF THE GENERAL WORK. ALL EXISTING CONDITIONS CANNOT BE COMPLETELY DETAILED ON THE DRAWINGS. THE CONTRACTOR SHALL SURVEY THE SITE AND INCLUDE ALL CHANGES IN MAKING UP THE WORK PROPOSAL.

H. PLAN INSTALLATION OF NEW WORK AND CONNECTIONS TO EXISTING WORK TO ENSURE MINIMUM INTERFERENCE WITH REGULAR OPERATION OF EXISTING FACILITIES. ALL SYSTEM SHUTDOWNS AFFECTING OTHER AREAS SHALL BE COORDINATED WITH BUILDING OWNER. INSTALL ISOLATION VALVES AT POINT OF CONNECTION TO THE EXISTING PIPING. PROVIDE TEMPORARY DUCT CAPS AND/OR CONNECTIONS TO MINIMIZE SHUTDOWN TIME.

I. CONNECT NEW WORK TO EXISTING WORK IN NEAT AND APPROVED MANNER. RESTORE EXISTING WORK DISTURBED WHILE INSTALLING NEW WORK TO ACCEPTABLE CONDITION AS DETERMINED BY ARCHITECT.

J. DISCONNECT, REMOVE AND/OR RELOCATE EXISTING MATERIAL, EQUIPMENT AND OTHER WORK AS NOTED OR REQUIRED FOR PROPER INSTALLATION OF NEW SYSTEM.

K. THE CONTRACTOR SHALL KEEP ALL EQUIPMENT AND MATERIALS, AND ALL PARTS OF THE BUILDING, EXTERIOR SPACES AND ADJACENT STREETS, SIDEWALKS AND PAVEMENTS, FREE FROM MATERIAL AND DEBRIS RESULTING FROM THE EXECUTION OF THIS WORK. EXCESS MATERIALS WILL NOT BE PERMITTED TO ACCUMULATE EITHER ON THE INTERIOR OR THE EXTERIOR.

L. SEAL OPENINGS AROUND DUCTS AND PIPING THROUGH PARTITIONS, WALLS AND FLOORS (NOT IN SHAFTS) WITH MINERAL WOOL OR OTHER NONCOMBUSTIBLE MATERIAL.

M. PROVIDE ALL NECESSARY FLASHING AND COUNTERFLASHING TO MAINTAIN THE WATERPROOFING INTEGRITY OF THIS BUILDING AS REQUIRED BY THE INSTALLATION OR REMOVAL OF PIPES, DUCTS, LOUVERS, CONDUIT, AND EQUIPMENT. PROVIDE EQUIPMENT CURBS AND DUNNAGE STEEL AS REQUIRED.

N. ALL PRESENT MATERIAL, EQUIPMENT AND CONSTRUCTION DEBRIS TO BE REMOVED UNDER THIS CONTRACT, WITH THE EXCEPTION OF SPECIFIC EQUIPMENT AND APPARATUS REQUESTED BY THE BUILDING REPRESENTATIVE, ARCHITECT OR AS NOTED TO BE RELOCATED ON THE DRAWINGS, SHALL BE PROPERLY DISPOSED OF BY THIS CONTRACTOR.

O. MATERIALS AND WORKMANSHIP, UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

P. THE WORK IN THE BUILDING SHALL BE DONE WHEN AND AS DIRECTED, AND IN A MANNER SATISFACTORY TO THE OWNER. THE WORK SHALL BE PERFORMED SO AS TO CAUSE THE LEAST POSSIBLE INCONVENIENCE AND DISTURBANCE TO THE PRESENT OCCUPANTS.

Q. THE CONTRACTOR'S PROPOSAL FOR ALL WORK SHALL BE PREDICATED ON THE PERFORMANCE OF THE WORK DURING REGULAR WORKING HOURS. WHEN SO DIRECTED, HOWEVER, THE CONTRACTOR SHALL INSTALL WORK IN OVERTIME AND THE

ADDITIONAL COST TO BE CHARGED THEREFORE SHALL BE ONLY THE PREMIUM PORTION OF THE WAGES PAID.

R. UNLESS OTHERWISE SPECIFIED, INCLUDE ALL CUTTING AND PATCHING OF EXISTING FLOORS, WALLS, PARTITIONS AND OTHER MATERIALS IN THE EXISTING BUILDING. THE CONTRACTOR SHALL RESTORE THESE AREAS TO ORIGINAL CONDITION.

S. ALL MATERIAL AND EQUIPMENT TO BE NEW UNLESS OTHERWISE NOTED AND SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

T. SUBMISSION OF A PROPOSAL SHALL BE CONSTRUED AS EVIDENCE THAT A CAREFUL EXAMINATION OF THE PORTIONS OF THE EXISTING BUILDING, EQUIPMENT, ETC. WHICH AFFECT THIS WORK, AND THE ACCESS TO SUCH SPACES, HAS BEEN MADE AND THAT THE CONTRACTOR IS FAMILIAR WITH EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT THE EXECUTION OF THE WORK. LATER CLAIMS SHALL NOT BE MADE FOR LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WHICH COULD HAVE BEEN FORESEEN DURING SUCH AN EXAMINATION. THE ON-SITE INSPECTION SHALL VERIFY EXISTING DUCTWORK, PIPING (SIZES, CLEARANCES, ETC.) AND CONDITIONS.

U. INSURANCE: IN ACCORDANCE WITH BUILDING REQUIREMENTS AND SHALL INCLUDE A HOLD HARMLESS CLAUSE FOR OWNER AND ENGINEER.

V. THE FINAL ACCEPTANCE WILL BE MADE AFTER THE CONTRACTOR HAS ADJUSTED HIS EQUIPMENT, BALANCED THE VARIOUS SYSTEMS, DEMONSTRATED THAT IT FULFILLS THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS AND HAS FURNISHED ALL THE REQUIRED CERTIFICATES OF INSPECTION AND APPROVAL.

W. GUARANTEE:

i. ALL MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THIS WORK. FINAL ACCEPTANCE SHALL BE DEFINED AS THE TIME AT WHICH THE MECHANICAL WORK IS TAKEN OVER AND ACCEPTED BY THE OWNER, AND IS UNDER CARE, CUSTODY, AND CONTROL OF THE OWNER. ENGAGE THE SERVICES OF VARIOUS MANUFACTURERS SUPPLYING THE EQUIPMENT FOR THE PROPER STARTUP AND OPERATION OF ALL SYSTEMS INSTALLED. INSTRUCT THE OWNERS PERSONNEL IN THE PROPER OPERATION AND SERVICING OF THE SYSTEM.

ii. THE CONTRACTOR SHALL GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY W0RKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN THE GUARANTEE PERIOD. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL INCLUDE RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS, REPAIRS OR REPLACEMENTS IN EQUIPMENT SUPPLIED BY THIS CONTRACTOR.

iii. THIS CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE AND OPERATION OF ALL SYSTEMS UNTIL THE FINAL ACCEPTANCE OF THE WORK.

iv. ALL AIR CONDITIONING UNIT COMPRESSORS AND REFRIGERATION COMPONENTS SHALL HAVE A 5-YEAR WARRANTY.

X. SPECIFICATIONS ARE OF SIMPLIFIED FORM AND INCLUDE INCOMPLETE SENTENCES. WORDS OR PHRASES SUCH AS "THE CONTRACTOR SHALL," "SHALL BE," "FURNISH," "PROVIDE," "A," "THE," AND "ALL" HAVE BEEN OMITTED FOR BREVITY.

Y. DEFINITIONS:

i. "PROVIDE": TO SUPPLY, INSTALL AND CONNECT UP COMPLETE AND READY FOR SAFE AND REGULAR OPERATION THE PARTICULAR WORK REFERRED TO UNLESS SPECIFICALLY OTHERWISE NOTED.

ii. "INSTALL": TO ERECT, MOUNT AND CONNECT COMPLETE WITH RELATED ACCESSORIES.

iii. "FURNISH" OR "SUPPLY": TO PURCHASE, PROCURE, ACQUIRE AND DELIVER COMPLETE WITH RELATED ACCESSORIES.

iv. "WORK": LABOR, MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES AND OTHER ITEMS REQUIRED FOR PROPER AND COMPLETE INSTALLATION.

v. "CONCEALED": EMBEDDED IN MASONRY OR OTHER CONSTRUCTION, INSTALLED IN FURRED SPACES, WITHIN DOUBLE PARTITIONS OR HUNG CEILINGS, IN TRENCHES, IN CRAWL SPACES, OR IN ENCLOSURES.

vi. "EXPOSED": NOT INSTALLED UNDERGROUND OR "CONCEALED" AS DEFINED ABOVE.

vii. "SIMILAR" OR "EQUAL": EQUAL IN MATERIALS, WEIGHT, SIZE, DESIGN AND EFFICIENCY OF SPECIFIED PRODUCT.

2. SCOPE OF WORK

A. THE WORK UNDER CONTRACT INCLUDES ALL LABOR, MATERIALS AND APPLIANCES NECESSARY FOR THE FURNISHING, INSTALLING AND TESTING, COMPLETE AND READY FOR SAFE OPERATION OF THE SYSTEMS. WORK SHALL BE INSTALLED IN A NEAT, WORKMANLIKE MANNER.

B. THE CONTRACTOR SHALL GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH THE DEPARTMENT HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT THIS WORK AND PAY ALL FEES THEREFORE. THE CONTRACTOR SHALL ARRANGE FOR INSPECTION AND TESTS OF ANY OR ALL PARTS OF

THE WORK IF SO REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. THE CONTRACTOR SHALL PAY ALL COSTS FOR, AND FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO THIS WORK.

C. THE CONTRACTOR SHALL FURNISH A WRITTEN GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY WORKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN ONE YEAR FROM THE DATE OF FINAL CERTIFICATE FOR PAYMENT AND/OR FROM DATE OR ACTUAL USE OF EQUIPMENT OR OCCUPANCY OF SPACES, BY OWNER, INCLUDED UNDER THE VARIOUS PARTS OF THE WORK, WHICHEVER DATE IS EARLIER. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL ALSO PROVIDE THAT WHERE DEFECTS OCCUR, THE CONTRACTOR WILL ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS, REPAIRS OR REPLACEMENTS IN EQUIPMENT SUPPLIED BY THE CONTRACTOR.

D. PERMITS AND FEES

i. THE CONTRACTOR SHALL GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH THE DEPARTMENT HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT THIS WORK AND PAY ALL FEES THEREFORE. THE CONTRACTOR SHALL ARRANGE FOR INSPECTION AND TEST OF ANY OR ALL PARTS OF THE WORK IF SO REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. THE CONTRACTOR SHALL PAY ALL COSTS FOR, FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO THIS WORK.

ii. THIS CONTRACTOR SHALL PREPARE OR HIRE THE NECESSARY CONSULTANTS TO PREPARE AND FILE ALL PLANS, CALCULATION, FORMS, ETC. REQUIRED FOR FILING WITH ALL AGENCIES REQUIRED FOR THIS WORK INCLUDING BUT NOT LIMITED TO THE DEP (DEPARTMENT OF ENVIRONMENTAL PROTECTION), DEC (DEPARTMENT OF ENVIRONMENTAL CONSERVATION), BUREAU OF AIR RESOURCES, EPA (ENVIRONMENTAL PROTECTION AGENCY), FDNY, ETC.

E. INSPECTIONS & TESTING / SPECIAL INSPECTIONS

i. THIRD PARTY INSPECTION AGENCY SHALL BE HIRED BY THE OWNER TO PERFORM ALL INSPECTIONS REQUIRED BY ALL LOCAL CODES.

F. PRIOR TO THE INSTALLATION OF ANY WORK AND PROCUREMENT OF EQUIPMENT PROVIDE COMPLETE SET OF COORDINATED SHOP DRAWINGS OF ALL NEW AND EXISTING EQUIPMENT, DUCTWORK, PIPING AND CONTROL SYSTEMS INDICATING CAPACITY DIMENSIONS AND SEQUENCE OF OPERATION FOR WRITTEN APPROVAL BY THE ARCHITECT AND ENGINEER.

G. WITHIN 15 DAYS AFTER AWARD OF CONTRACT, SUBMIT FOR REVIEW, A LIST OF ALL MATERIAL AND EQUIPMENT MANUFACTURER'S PRODUCTS THAT ARE PROPOSED, AS WELL AS NAMES OF ALL SUBCONTRACTORS WHOM THIS TRADE PROPOSES TO UTILIZE ON THIS PROJECT.

3. SHOP DRAWINGS

A. INDICATE ON EACH SUBMISSION: PROJECT NAME AND LOCATION, ARCHITECT AND ENGINEER, ITEM IDENTIFICATION AND APPROVAL STAMP OF PRIME CONTRACTOR, SUBCONTRACTOR NAMES AND PHONE NUMBERS, REFERENCE TO THE APPLICABLE DESIGN DRAWING OR SPECIFICATION ARTICLE, DATE AND SCALE.

B. THE WORK DESCRIBED IN ALL SHOP DRAWING SUBMISSION SHALL BE CAREFULLY CHECKED FOR ALL CLEARANCES (INCLUDING THOSE REQUIRED FOR MAINTENANCE AND SERVICING), FIELD CONDITIONS, MAINTENANCE OF ARCHITECTURAL CONDITIONS AND PROPER COORDINATION WITH ALL TRADES ON THE JOB.

C. EACH SUBMITTED SHOP DRAWING IS TO INCLUDE A CERTIFICATION THAT ALL RELATED JOB CONDITIONS HAVE BEEN CHECKED AND VERIFIED AND THAT THERE ARE NO CONFLICTS.

D. ALL SHOP DRAWINGS ARE TO BE SUBMITTED TO ALLOW 5 BUSINESS DAYS FOR CHECKING IN ADVANCE OF FIELD REQUIREMENTS. ALL SUBMITTALS TO BE COMPLETE AND CONTAIN ALL REQUIRED AND DETAILED INFORMATION. SHOP DRAWINGS WITH MULTIPLE PARTS SHALL BE SUBMITTED AS A PACKAGE.

E. IF SUBMITTALS DIFFER FROM THE CONTRACT DOCUMENT REQUIREMENTS, MAKE SPECIFIC MENTION OF SUCH DIFFERENCES IN A LETTER OF TRANSMITTAL, WITH REQUEST FOR SUBSTITUTION, TOGETHER WITH REASONS FOR SAME.

F. ELECTRONIC COPIES OF ENGINEERING DRAWINGS:

i. IF THE CONTRACTOR REQUIRES (.DWG) FORMAT. THE DRAWINGS WILL BE FORWARDED ONLY UPON RECEIPT OF SIGNED ACCEPTANCE OF TERMS FORM. PERMISSION FROM THE ARCHITECT MUST FIRST BE OBTAINED FOR ENGINEER TO INCLUDE THE ARCHITECTURAL BACKGROUND AS REFERENCE. THE CONTRACTOR IS TO OBTAIN THE ARCHITECT'S LATEST DRAWINGS DIRECTLY FROM THE ARCHITECT.

ii. THESE FILES ARE BEING ISSUED FOR THE CONVENIENCE OF THE CONTRACTOR AND THE CONTRACTOR REMAINS RESPONSIBLE FOR ALL CONTRACT REQUIREMENTS RELATED TO THE NORMAL SHOP DRAWING PREPARATION PROCESS.

G. SUBMISSIONS:

i. PROVIDE ALL COORDINATION DRAWINGS, DUCTWORK AND PIPING SHOP

DRAWINGS IN PDF FORMAT – PAPER SUBMISSIONS SHALL NOT BE ACCEPTED. THE ARCHITECT WILL FORWARD ALL SUBMISSIONS TO THE ENGINEER.

H. SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:

i. SHEET METAL SHOP DRAWING (3/8 INCH SCALE)

ii. SHEET METAL & PIPING SHOP STANDARDS

SHEETMETAL SHOP STANDARDS SHALL BE COMPILED DIRECTLY FROM THE “SMACNA DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE” MANUAL. MODIFICATIONS FOR A SPECIFIC PROJECT, IF ANY, SHALL BE INDICATED DIRECTLY ON THE SMACNA TEMPLATES. MODIFIED SHOP STANDARDS NOT TAKEN DIRECTLY FROM THE SMACNA TEMPLATES WILL NOT BE ACCEPTED. ANY DEVIATIONS FROM SMACNA SHALL BE NOTED.

iii. AC UNITS

iv. FANS

v. PIPING LAYOUT: DETAIL, AT 3/8 INCH SCALE PIPING LAYOUT WITH FITTINGS, VALVES AND EQUIPMENT, USE SINGLE LINE FOR PIPE SIZES 3 INCHES AND SMALLER, AND DOUBLE LINE FOR PIPE SIZES 4 INCHES AND GREATER. FABRICATION OF PIPE ANCHORS, HANGERS, SUPPORTS FOR MULTIPLE PIPES, ALIGNMENT GUIDES, EXPANSION JOINTS AND LOOPS, AND ATTACHMENTS OF THE SAME TO THE BUILDING STRUCTURE. DETAIL LOCATION OF ANCHORS, ALIGNMENT GUIDES, AND EXPANSION JOINTS AND LOOPS SUBMIT ALL WELDING CERTIFICATES.

vi. VIBRATION ISOLATION

vii. DAMPER AND VALVE ACTUATORS

viii. AUTOMATIC CONTROL SYSTEMS AND DEVICES

ix. SEQUENCE OF OPERATIONS

I. COORDINATION DRAWINGS: CONTRACTOR SHALL PROVIDE PLANS AT 3/8 INCH SCALE INDICATING COORDINATION BETWEEN THE TRADES USING INPUT FROM INSTALLERS OF THE ITEMS INVOLVED.

i. DUCT AND PIPING INSTALLATION INDICATING COORDINATION WITH GENERAL CONSTRUCTION, BUILDING COMPONENTS, AND OTHER BUILDING SERVICES. INDICATE LOCATIONS AND SIZES OF ALL OPENINGS IN FLOOR, WALLS AND ROOF THAT MAY BE REQUIRED.

ii. COORDINATION WITH SUSPENDED CEILING COMPONENTS, STRUCTURAL MEMBERS TO WHICH DUCT WILL BE ATTACHED, SIZE AND LOCATION OF INITIAL ACCESS MODULES FOR ACOUSTICAL TILE, PENETRATIONS OF SMOKE BARRIERS AND FIRE-RATED CONSTRUCTION, LIGHTING FIXTURES, AIR OUTLETS AND INLETS, SPEAKERS, SPRINKLERS, ACCESS PANELS, PERIMETER MOLDINGS SHALL BE PERFORMED.

4. AS-BUILTS AND EQUIPMENT OPERATION INSTRUCTIONS

A. PROVIDE ALL COORDINATION DRAWINGS, DUCTWORK AND PIPING AS-BUILTS IN AUTOCAD 2013 AND PDF FORMAT. ALL CATALOG CUTS AND SUBMITTALS TO BE PROVIDED IN ELECTRONIC PDF FORMAT. THE ARCHITECT WILL FORWARD ALL SUBMISSIONS TO THE ENGINEER.

B. ON COMPLETION AND ACCEPTANCE OF WORK, THIS CONTRACTOR SHALL FURNISH WRITTEN INSTRUCTIONS, EQUIPMENT MANUALS AND DEMONSTRATE TO THE OWNER THE PROPER OPERATION AND MAINTENANCE OF ALL EQUIPMENT AND APPARATUS FURNISHED UNDER THIS CONTRACT.

C. THESE INSTRUCTIONS SHALL BE TYPED ON 8-1/2 INCH X 11 IN FORMAT. THE CONTRACTOR SHALL GIVE ONE COPY OF THE INSTRUCTIONS TO THE OWNER AND ONE COPY TO THE ENGINEER.

D. THE INSTRUCTIONS SHALL BE ORGANIZED IN SECTIONS, WITH ONE SECTION PER SYSTEM. THE COVER OF THE INSTRUCTION BOOKLET SHALL BEAR THE NAME, ADDRESS AND PHONE NUMBER OF THE PROJECT, ARCHITECT, ENGINEER, MECHANICAL CONTRACTOR AND SUBCONTRACTORS.

E. FINAL AS-BUILT DRAWINGS INDICATING AS INSTALLED CONDITIONS SHALL BE PROVIDED TO THE ARCHITECT AND ENGINEER AFTER COMPLETION OF THE INSTALLATION.

5. SUBSTITUTIONS

A. NO SUBSTITUTE MATERIAL OR MANUFACTURER OF EQUIPMENT SHALL BE PERMITTED WITHOUT A FORMAL WRITTEN SUBMITTAL TO THE ENGINEER WHICH INCLUDES ALL DIMENSIONAL, PERFORMANCE AND MATERIAL SPECIFICATIONS. ANY CHANGES IN LAYOUT, ELECTRICAL CHARACTERISTICS, STRUCTURAL REQUIREMENTS OR DESIGN DUE TO THE USE OF A SUBSTITUTION SHALL BE SUBMITTED TO THE ENGINEER AS PART OF THIS PROPOSAL. THE CONTRACTOR TAKES FULL RESPONSIBILITY FOR THE SUBSTITUTION AND ALL CHANGES RESULTING FROM THE SUBSTITUTION. ALL ITEMS SHALL BE SUBMITTED FOR REVIEW IN CONJUNCTION WITH THE SUBMITTAL OF THE SUBSTITUTION. ANY SUBSTITUTION MUST BE SUBMITTED WITH AN EXPLANATION WHY A SUBSTITUTION IS BEING UTILIZED. IF THE SUBSTITUTED ITEM DEVIATES FROM THE SPECIFIED ITEM, THOSE DEVIATIONS ARE TO BE IDENTIFIED ON A LINE BY LINE BASIS. IF THE SUBSTITUTE IS BEING UTILIZED FOR FINANCIAL REASONS, THE ASSOCIATED CREDIT MUST BE SIMULTANEOUSLY SUBMITTED.

B. ALL SUBSTITUTED EQUIPMENT SHALL CONFORM TO SPACE REQUIREMENTS AND PERFORMANCE REQUIREMENTS SHOWN ON CONTRACT DOCUMENTS. CONTRACTOR SHALL REPLACE ANY EQUIPMENT THAT DOES NOT MEET THESE REQUIREMENTS AT HIS OWN EXPENSE. ANY MODIFICATIONS TO ASSOCIATED SYSTEMS OR ADDITIONAL COSTS ATTRIBUTED TO THIS SUBSTITUTION SHALL BE AT THIS CONTRACTOR'S EXPENSE.

C. CONTRACTOR SHALL SUBMIT BID BASED ON SPECIFIED ITEMS AND SHALL SUPPLY AS AN ALTERNATE PRICE ANY SUBSTITUTIONS.

6. SERVICE AND WARRANTY (MAINTENANCE CONTRACT)

A. THIS CONTRACTOR SHALL PROVIDE AS AN ADD ALTERNATE PRICE, A FULL ONE YEAR SERVICE OF ALL MECHANICAL COMPONENTS AND SYSTEMS, WITH PRICES FOR YEARS 2, 3 AND 4 FOLLOWING THIS FIRST YEAR. AT THE TIME OF ACCEPTANCE OF PROJECT, THE TENANT OR OWNER'S REPRESENTATIVE WILL DECIDE TO ACCEPT WHICH ALTERNATE, IF ANY. THIS IS IN ADDITION TO THE WARRANTY BEING PROVIDED AS PART OF THE BASE CONTRACT.

7. ACCESS DOORS IN GENERAL CONSTRUCTION

A. THIS CONTRACTOR SHALL SUBMIT TO THE ARCHITECT FOR APPROVAL A PLAN INDICATING THE SIZE (MINIMUM 18 INCH X 18 INCH) AND LOCATION OF ALL ACCESS DOORS REQUIRED FOR OPERATION AND MAINTENANCE OF ALL CONCEALED EQUIPMENT, DEVICES, VALVES, DAMPERS AND CONTROLS. CONTRACTOR SHALL ARRANGE FOR FURNISHING AND INSTALLATION OF ALL ACCESS DOORS IN FINISHED CONSTRUCTION AND INCLUDE COSTS IN THE BID.

B. REMOVABLE ACCESS TILE AND/OR ACCESS DOOR ARE REQUIRED IN HUNG CEILINGS, SHAFTS AND WALLS FOR ALL EQUIPMENT, DAMPERS, VALVES, ETC. HVAC CONTRACTOR TO FURNISH ACCESS LOCATION REQUIREMENTS TO GENERAL CONTRACTOR. ACCESS TILE IDENTIFICATION: PROVIDE BUTTONS, TABS, AND MARKERS TO IDENTIFY LOCATION OF CONCEALED VALVES, DAMPERS AND EQUIPMENT.

8. SHEET METAL WORK

A. DUCT CONSTRUCTION, INCLUDING SHEET METAL THICKNESSES, SEAM AND JOINT CONSTRUCTION, REINFORCEMENTS, HANGERS AND SUPPORTS, SHALL COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" LATEST EDITION AND PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA INDICATED.

B. EXCEPT AS OTHERWISE SHOWN OR NOTED, ALL DUCTWORK AND OTHER SHEET METAL WORK SHALL BE GALVANIZED SHEET STEEL

C. DESCRIPTION OF DUCTWORK PRESSURE CLASS AND EQUIPMENT:

i. 2 INCH DUCT CLASS AND LESS: ALL OTHER LOW PRESSURE DUCTOWORK. SEAL CLASS C, LEAKAGE CLASS 24 (RECTANGULAR) OR CLASS 12 (ROUND).

ii. 3 INCH DUCT CLASS: ALL SUCTION AND DISCHARGE OF KITCHEN EXHAUST AND OTHER EXHAUST DUCTWORK. SEAL CLASS B, LEAKAGE CLASS 12 RECTANGULAR METAL OR CLASS 6 (ROUND).

iii. 4 INCH AND GREATER DUCT CLASS: ALL SUPPLY/RETURN DUCTWORK FROM DISCHARGE/INTAKE OF FANS, AIR HANDLING UNITS OR AC UNITS TO INLET/OUTLET OF TERMINAL BOXES ON FLOOR, ALL OUTDOOR DUCTWORK AND ALL DUCTWORK RUNNING THROUGH UNCONDITIONED SPACES. SEAL CLASS A, LEAKAGE CLASS 6 (RECTANGULAR METAL) OR CLASS 3 (ROUND).

D. GENERAL FABRICATION REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", LATEST EDITION, BASED ON INDICATED STATIC-PRESSURE CLASS UNLESS OTHERWISE INDICATED.

i. THE FOLLOWING FITTING CONNECTIONS AND DUCT CONSTRUCTION GAUGES ARE NOT ACCEPTABLE

a) DRIVE SLIP [T-1, T-2] FITTING CONNECTIONS

b) 26 GAUGE DUCTWORK.

ii. TRANSVERSE JOINTS: SELECT JOINT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", "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." FITTINGS AND/OR JOINTS OF TWO DIFFERENT GAUGES, CONNECTED JOINT RATING SHALL MEET MORE STRINGENT CONDITIONS.

iii. USE THE FOLLOWING SMACNA TRANSVERSE (GIRTH) JOINTS

a) DUCT CONSTRUCTION AS FOLLOWS FOR 2 INCH W.G. CLASS:
(1) UP TO 12 INCH WIDE USE T-6 OR T-7
(2) 13 INCH TO 28 INCH WIDE USE T-11 OR T12
(3) 29 INCH WIDE AND UP USE TDC OR TDF

b) DUCT CONSTRUCTION AS FOLLOWS FOR 3 INCH W.G. CLASS:
(1) UP TO 20 INCH WIDE USE T-6 OR T-7
(2) 21 INCH TO 24 INCH WIDE USE T-11 OR T12
(3) 25 INCH WIDE AND UP USE TDC OR TDF

c) DUCT CONSTRUCTION AS FOLLOWS FOR 4 INCH W.G. CLASS:
(1) UP TO 12 INCH WIDE USE T-6 OR T-7

(2) 13 INCH TO 18 INCH WIDE USE T-11 OR T12
(3) 19 INCH WIDE AND UP USE TDC OR TDF

E. VOLUME DAMPERS: GALVANIZED STEEL, PER SMACNA "LOW VELOCITY MANUAL," EXCEPT PROVIDE BEARING AT ONE END OF DAMPER ROD AND QUADRANT, WITH LEVER AND LOCKSCREW AT OTHER END. FOR INSULATED DUCTS, QUADRANTS MOUNTED ON COLLAR TO CLEAR INSULATION. INSTALL WITH LEVERS ACCESSIBLE.

i. PROVIDE MANUAL BALANCING VOLUME DAMPERS AS REQUIRED TO PROPERLY BALANCE THE AIR DISTRIBUTION SYSTEM. IF THE LOCATION OF BALANCING DAMPERS ARE NOT DEFINED ON THE DRAWINGS, THE FOLLOWING MINIMUM STANDARDS SHALL GOVERN:

a) LOW PRESSURE: ALL SUPPLY AIR MAIN BRANCHES FROM TRUNK, EACH SPLIT, AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.

b) LOW PRESSURE: ALL EXHAUST AND RETURN BRANCHES FROM TRUNK, EACH SPLIT AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.

F. FLEXIBLE DUCTWORK SHALL NOT BE USED ON THIS PROJECT.

G. ACCESS DOORS: INSULATED OR UNINSULATED, SAME AS DUCT.

i. PROVIDE MINIMUM 20 INCH X 14 INCH ON MAIN DUCTS, AND 12 INCH X 6 INCH ON BRANCH DUCTS, UNLESS OTHERWISE APPROVED, AT FIRE DAMPERS, AND AT ALL DUCT ACCESSORIES SUCH AS HUMIDIFIERS, DUCT SMOKE DETECTORS, AUTO DAMPERS, AND LOUVERS.

ii. ALL ACCESS DOORS TO BE HINGED, WITH LATCH SIMILAR TO VENTLOCK NO. 100.

H. FLEXIBLE CONNECTIONS: NEOPRENE-COATED GLASS FABRIC, 30 OZ PER SQUARE YD WITH SEWED AND CEMENTED SEAMS, SIMILAR TO VENT FABRICS. PROVIDE WITH METAL COLLARS. ALLOW MINIMUM MOVEMENT OF 1 INCH.

I. TURNING VANES: GALVANIZED STEEL SMALL DOUBLE-THICKNESS VANES WITH 2 INCH INSIDE RADIUS.

J. FIRE DAMPERS: DYNAMIC; RATED AND LABELED ACCORDING TO UL 555 BY AN NRTL GALVANIZED STEEL CONSTRUCTION, CURTAIN TYPE WITH BLADES OUT OF THE AIRSTREAM (TYPE B), SPRING LOADED, EQUIPPED WITH FUSIBLE LINK, CONFORMING TO NFPA STANDARD 90A AND APPROVED BY NEW YORK CITY, SIMILAR TO POTOROFF OR RUSKIN, RATED AS REQUIRED. PROVIDE FIRE DAMPERS AS NOTED ON THE PLANS AND IN DUCTS AND OPENINGS IN SHAFTS, FLOORS, FIRE WALLS, FIRE-RESISTANCE PARTITIONS, FIRE RATED CEILINGS, EXIT CORRIDOR WALLS. PROVIDE ACCESS DOOR IN

DUCT ADJACENT TO EACH FIRE DAMPER. SEE INSTALLATION ON DRAWING.

K. COMBINATION FIRE/SMOKE DAMPERS:

i. COMBINATION FIRE/SMOKE DAMPERS SHALL BE INSTALLED AS INDICATED ON DRAWING AND AS REQUIRED BY LOCAL CODES. DAMPERS TO BE UL 555S LATEST EDITION LISTED AND LABELED AND IN CONFORMANCE WITH NFPA.

ii. COMBINATION FIRE/SMOKE DAMPERS SHALL BE CLASS 1 (ONE), DUAL OVERRIDE REMOTE RESETTABLE, OPPOSED MULTIBLADE TYPE WITH FIRESTAT OR EQUIVALENT HEAT RESPONSIVE DEVICE, 120-VOLT ACTUATOR AS REQUIRED MOUNTED OUT OF THE AIR STREAM, WITH DAMPER OPERATOR AND BLADE POSITION INDICATOR SWITCHES. PROVIDE MOTOR MOUNT BRACKET STRENGTHENER FOR DAMPERS OVER 10 INCH IN HEIGHT. PROVIDE A 10 GAUGE WELDED VERTICAL STIFFENER AT EACH CORNER TO PREVENT DAMPER MISALIGNMENT.

iii. PROVIDE ACCESS DOOR IN DUCT ADJACENT TO EACH FIRE/SMOKE DAMPER.

iv. PROVIDE FIRE/SMOKE DAMPERS AS NOTED ON THE PLANS AND IN DUCTS AND OPENINGS IN SHAFTS, FLOORS, FIRE WALLS, FIRE-RESISTANCE PARTITIONS, FIRE RATED CEILINGS AND SMOKE BARRIERS.

v. THE HVAC CONTRACTOR SHALL PROVIDE ALL DEVICES, RELAYS, END SWITCHES, E/P SWITCHES, CONTROL COMPONENTS, AIR PIPING, POWER WIRING, CONTROL WIRING AND INTERLOCK WIRING AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF OPERATION FOR THESE DAMPERS.

vi. DAMPERS SHALL BE MANUFACTURED BY GREENHECK MODEL FSD-311, RUSKIN MODEL FSD-60, OR APPROVED EQUAL.

vii. MODULATING COMBINATION FIRE/SMOKE DAMPERS TO BE PROVIDED WITH ACTUATORS RATED AND TESTED FOR THIS APPLICATION.

viii. SEE INSTALLATION ON DRAWING.

L. ALL DUCT DIMENSIONS INDICATED ON PLANS ARE INSIDE CLEAR DIMENSIONS. INCREASE DUCT DIMENSIONS AS REQUIRED TO ACCOUNT FOR INTERNAL LINING.

M. AUTOMATIC DAMPERS: COMPLETE WITH LINKAGE AND ELECTRIC OPERATOR. OPPOSED BLADE DAMPER OR GALVANIZED STEEL MIN. 4 INCH, MAX. 8 INCH WIDE WITH COMPRESSIBLE EDGE SEALS TO PREVENT LEAKAGE. FACTORY-ASSEMBLE STEEL LINKAGE AND SHAFT WITH NYLON OR OIL-IMPREGNATED BRONZE BEARINGS. MOTOR WITH SUFFICIENT POWER TO LIMIT LEAKAGE TO 10 CFM PER SQUARE FEET. LINKAGE TO WITHSTAND LOAD EQUAL TO TWICE MAXIMUM OPERATING FORCE WITHOUT DEFLECTION. DAMPER MOUNTED IN WELDED STEEL CHANNEL FRAME.

i. SHUTOFF DAMPERS SHALL BE CLASS I MOTORIZED DAMPERS WITH AN AIR LEAKAGE RATE NOT GREATER THAN 4 CFM/SF OF DAMPER SURFACE AREA AT 1.0 INCH WG AND AMCA 500D LISTED.

N. EXTERIOR LOUVERS: 4 INCH WIDE STATIONARY LOUVER, EXTRUDED ALUMINUM, 0.081 INCH WALL THICKNESS, 6063T5 ALLOY BLADES AND FRAME WITH STAINLESS STEEL OR ALUMINUM FASTENERS. LOUVER TO INCORPORATE STRUCTURAL SUPPORT TO WITHSTAND WIND LOAD OF 20 LBS PER SQUARE FEET. PROVIDE REMOVABLE 3/4 INCH X 3/4 INCH ALUMINUM BIRDSCREEN IN AN ALUMINUM FRAME. AIR PERFORMANCE AND WATER PENETRATION LESS THAN OR EQUAL TO GREENHECK. COORDINATE ALL REQUIREMENTS WITH THE BUILDING MANAGEMENT AND ARCHITECT. LOUVER TO COMPLY WITH BASE BUILDING STANDARDS.

O. ALUMINUM DUCTWORK:

i. ALUMINUM SHEETS: COMPLY WITH ASTM B 209ALLOY 3003, H14 TEMPER; WITH MILL FINISH FOR CONCEALED DUCTS, AND STANDARD, ONE-SIDE BRIGHT FINISH FOR DUCT SURFACES EXPOSED TO VIEW.

ii. ALL OUTSIDE AIR, EXHAUST, AND RELIEF DUCTWORK WITHIN 5 FEET OF LOUVERS SHALL BE ALUMINUM WITH SEAMS SEALED WATERTIGHT WITH ALCOA ALUMINASTIC TYPE C SEAM SEALER OR SOLDER. PITCH DUCTWORK TOWARDS LOUVER.

P. WIRE MESH SCREEN (WMS): NO. 16 USSG, 3/4 SQUARE MESH, IN 1 INCH WIDE GALVANIZED STEEL ENCLOSING FRAME. FLANGED DUCT OPENING TO RECEIVE FRAME.

Q. LEAKAGE TESTING:

I. ALL DUCTWORK GREATER THAN 2 INCH CLASS AS DEFINED WITHIN IS TO BE TESTED. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL COLLARS, CAPS, ELECTRIC POWER, ETC. NECESSARY TO PERFORM THE TESTS. THE CONTRACTOR IS ALSO RESPONSIBLE FOR SCHEDULING THE TEST NO LESS THAN THREE (3) BUSINESS DAYS PRIOR TO ITS INTENDED OCCURRENCE. LOW PRESSURE DUCTWORK (2 INCH CLASS) SHALL BE TESTED ON AN AS NEEDED BASIS AT THE ENGINEER'S DIRECTION. LEAKAGE TEST PROCEDURE SHALL FOLLOW THE OUTLINES AND CLASSIFICATIONS IN THE SMACNA HVAC DUCT LEAKAGE TEST MANUAL. IF SPECIMEN FAILS TO MEET ALLOTTED LEAKAGE LEVEL, THE CONTRACTOR SHALL MODIFY TO BRING IT INTO COMPLIANCE AND SHALL RETEST IT UNTIL ACCEPTABLE LEAKAGE IS DEMONSTRATED. TESTS AND NECESSARY REPAIR SHALL BE COMPLETED AND A REPORT SHALL BE SUBMITTED TO AND APPROVED BY ENGINEER PRIOR TO CONCEALMENT OF DUCTS.

9. AIR OUTLETS

A. GENERAL:

i. MARGIN TYPES, COLORS, FINISH AND METHODS OF ATTACHMENT FOR ALL DIFFUSERS, GRILLES AND REGISTERS SHALL BE COORDINATED WITH ARCHITECTURAL CEILING AND WALL DETAILS AND SPECIFICATIONS. FINISH SHALL MATCH COLOR SAMPLE AS APPROVED:

ii. FRAME TYPE SUITABLE FOR MOUNTING IN CEILING OR WALL CONSTRUCTION AS INDICATED ON ARCHITECTURAL PLANS.

iii. EXACT LOCATION OF ALL AIR OUTLETS AS PER ARCHITECTURAL PLANS.

iv. PROVIDE MOUNTING AND BLOCKING

v. SUITABLE FOR OPERATION AT 20% EXCESS AND 20% LESS THAN NOTED CAPACITY FOR CONSTANT VOLUME SYSTEMS AND AT 20% EXCESS AND 60% LESS THAN NOTED CAPACITY FOR VARIABLE VOLUME SYSTEMS.

vi. MANUFACTURER RESPONSIBLE FOR EXAMINING APPLICATION OF EACH OUTLET AND GUARANTEE THAT EACH WILL PROVIDE REQUIRED NC LEVELS AND COMFORT SPACE CONDITIONS WITHOUT DRAFTS THROUGHOUT OPERATING RANGE.

vii. ALL REGISTERS SHALL BE PROVIDED WITH OPPOSED BLADE VOLUME DAMPERS. DAMPER OPERATING LEVERS SHALL BE ACCESSIBLE AT THE FACE OF AIR OUTLETS. CEILING DIFFUSERS SHALL NOT HAVE BUTTERFLY DAMPERS WITHIN NECK.

viii. ONLY FOUR (4) WAY DIFFUSERS SHALL BE PROVIDED. PROVIDE SHEETMETAL BLANK OFF AS REQUIRED FOR 1 WAY, 2 WAY OR 3 WAY DIFFUSERS.

ix. PROVIDE BLANKING FOR PROPER COVERAGE AND BLOW WITHOUT PRODUCING OBJECTIONABLE NOISE OR AIR MOTION AT OCCUPIED LEVEL.

x. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

a) ANEMOSTAT PRODUCTS; A MESTEK COMPANY.

b) TITUS.

c) PRICE INDUSTRIES

B. LINEAR DIFFUSERS: EXTRUDED ALUMINUM CONSTRUCTION, FINISH AS PER ARCHITECT, REMOVABLE CORE, AIR DEFLECTION VANE AND CABLE DAMPER IN EACH BRANCH TAP WITH 3 FEET CABLE TO DIFFUSER FACE.

i. LINEAR DIFFUSERS: FRAME TYPES SHALL MATE WITH CEILINGS. PROVIDE MEANS TO NEATLY BUTT AND ALIGN UNITS TO GIVE CONTINUOUS

APPEARANCE WITHOUT BUTTING FLANGES. NO SCREW HOLES OR WELDED CORNERS VISIBLE ON DIFFUSERS OR FRAMES WILL BE PERMITTED. AIR VOLUME SHALL BE ADJUSTABLE THROUGH AIR SUPPLY FACE WITHOUT REQUIRING REMOVAL OF FACE PANEL. PROVIDE BLANKED SECTIONS FOR INACTIVE LENGTHS. PROVIDE PLASTER FRAMES AND OPPOSED BLADE VOLUME DAMPERS WITH REMOTE CABLE OPERATORS WHERE NOTED. REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING DETAILS AND OVERALL LENGTHS.

C. SQUARE DIFFUSERS: DIFFUSERS SHALL BE STEEL CONSTRUCTION PAINTED WHITE SUITABLE FOR THE TYPE OF CEILING.

D. REGISTERS AND GRILLES:

i. RETURN AND EXHAUST REGISTERS: STEEL CONSTRUCTION WITH VOLUME DAMPER.

ii. SUPPLY REGISTERS: STEEL CONSTRUCTION ADJUSTABLE DOUBLE DEFLECTION STEEL AIRFOIL LOUVERS, WITH VOLUME DAMPER. PROVIDE AIR EQUALIZING DEFLECTOR WHERE REGISTER COLLAR DUCT IS LESS THAN 2 FEET LONG.

iii. TRANSFER GRILLES: STEEL CONSTRUCTION WITHOUT VOLUME DAMPER.

10. NOISE CONTROL

A. ALL ROOM NC LEVELS SHALL BE 35 OR LESS.

B. PROVIDE SOUNDLINING FOR THE FOLLOWING DUCTWORK:

i. ALL DUCTWORK WITHIN MECHANICAL ROOMS AND NOT LESS THAN 25 FEET ON EACH SIDE OF ALL FANS AND AC UNITS.

ii. ALL AIR TRANSFER AND JUMPER DUCTS.

iii. RETURN AIR STUB DUCTS AT MER WALLS AND SHAFT INTAKE OPENINGS FOR FULL LENGTH.

iv. DOWNSTREAM OF ALL TERMINAL BOXES (CV, VAV) FOR A MINIMUM OF 15 FEET).

v. ALL MIXED AIR PLENUMS, EXCEPT WHERE MOISTURE CARRYOVER FROM OUTDOOR AIR LOUVER WILL OCCUR.

vi. EXPOSED SUPPLY DUCTWORK SHALL BE ACOUSTICALLY LINED IN LIEU OF EXTERNAL INSULATION.

vii. ALSO WHERE NOTED ON A DRAWING.

C. SOUNDLINING IN DUCTWORK: FIBROUS GLASS, MINIMUM 3 LB DENSITY, 1-1/2 INCH THICKNESS, MAXIMUM 0.25 K FACTOR AT 75°F MEAN TEMPERATURE WITH ACRYLIC COATED FINISH FACTORY APPLIED EDGE COATING AND STENCILED IN ACCORDANCE WITH NFPA 90. FLAMESPREAD SHALL BE A MAXIMUM OF 25. LINING SHALL NOT SUPPORT MICROBIAL GROWTH AND SHALL BE TESTED IN ACCORDANCE WITH ASTM C 1071 AND ASTM G21/G22. SIMILAR TO MANVILLE PERMACOTE LINACOUSTIC.

D. ALL SOUNDLINING, ADHESIVES, FACES AND ACCESSORIES TO BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, EXCEPT AS OTHERWISE NOTED.

11. TESTING AND BALANCING

A. ALL AIR AND WATER BALANCING SHALL BE BY AN INDEPENDENT CONTRACTOR NOT AFFILIATED WITH THE MECHANICAL CONTRACTOR AND IN ACCORDANCE WITH LOCAL STANDARDS. CONTRACTOR SHALL UTILIZE BASE BUILDING BALANCING CONTRACTOR OR APPROVED EQUAL, CONTACT BUILDING MANAGEMENT.

B. CONTRACTOR TO BALANCE ENTIRE SYSTEM TO AIR AND/OR WATER QUANTITIES AS SHOWN ON ALL RELATED DRAWINGS FOR THIS JOB, AND AS DESCRIBED HEREIN. BALANCING MUST BE DONE IN THE PRESENCE OF A BUILDING ENGINEER.

C. AIR BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF FANS AND BRANCH DAMPERS FOR MAJOR ADJUSTMENTS. AIR SUPPLY OUTLETS TO BE BALANCED TO A UNIFORM SUPPLY ACROSS ENTIRE FACE. ADJUSTMENT OF TERMINAL DAMPERS AND DEVICES SHALL BE FOR TRIM OR MINOR ADJUSTMENT ONLY. THIS SHALL BE DONE TO PERMIT THE LEAST NOISE GENERATION IN THE TERMINAL AREAS AND UTILIZE MINIMUM FAN ENERGY.

D. WATER BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF BALANCING VALVES AT PUMPS FOR PROPER FLOW. ADJUST FLOW THROUGH COILS AS REQUIRED.

E. UPON COMPLETION OF THE INSTALLATION, THE CONTRACTOR SHALL REBALANCE ANY EXISTING PORTIONS OF AIR DISTRIBUTION SYSTEM AND WATER DISTRIBUTION SYSTEM AFFECTED BY THE RENOVATION AND ALSO BALANCE ALL NEW WORK.

F. IF DISCREPANCIES EXIST IN THE REPORT THAT REQUIRE FIELD VERIFICATION, THE TESTING AND BALANCING COMPANY IN THE PRESENCE OF THE ENGINEER SHALL VISIT THE JOBSITE FOR FIELD VERIFICATION OF THE REPORT.

G. THE CONTRACTOR SHALL PROVIDE ALL LABOR, PRESSURE GAUGES, FLOW METERS, SHEAVES, AND BELTS REQUIRED TO BALANCE SYSTEMS.

H. BALANCING REPORT SHALL BE PROVIDED ON NEBB OR AABC-TYPE FORMS.

I. BALANCING AND TESTING SHALL BE PERFORMED AND SUPERVISED BY A CERTIFIED NEBB OR AABC TECHNICIAN.

J. BALANCING AND TESTING SHALL BE PERFORMED AND SUPERVISED BY ONE OF THE FOLLOWING INDEPENDENT FIRMS SPECIALIZING IN TESTING AND BALANCING:

I. INTERNATIONAL TESTING AND BALANCING

II. INDEPENDENT TESTING & BALANCING

III. MERENDINO ASSOCIATES.

K. THE PERFORMANCE AND CAPACITY OF ALL SYSTEMS AND EQUIPMENT TO BE DEMONSTRATED BY THE CONTRACTOR.

L. AFTER SUBMISSION OF THE FIELD VERIFIED BALANCING REPORT, THE AIR BALANCING COMPANY SHALL RETURN TO THE JOB SITE TO PERFORM TWO (2) OCCUPANT COMFORT BALANCES AS DIRECTED BY THE OWNER OR ENGINEER

M. THE FINAL REPORT AFTER THE COMFORT BALANCE IS TO BE INCLUDED IN PROJECT OPERATING AND MAINTENANCE MANUAL TO OWNER AND ENGINEER.

N. THE TESTING AND BALANCING AGENCY SHALL INCLUDE AS PART OF THEIR WORK AN EXTENDED WARRANTY OF 90 DAYS AFTER COMPLETION OF TEST AND BALANCE WORK. THE ENGINEER AT HIS DISCRETION DURING THE WARRANTY PERIOD MAY REQUEST A RECHECK, OR RESETTING OF ANY EQUIPMENT. THE MECHANICAL CONTRACTOR AND THE BALANCING CONTRACTOR SHALL PROVIDE THE NECESSARY TECHNICIANS TO FACILITATE THIS WORK.

O. BALANCING AGENCY SHALL PERMANENTLY MARK ALL ADJUSTMENT DEVICES (VALVES, DAMPERS, ETC.) TO ENABLE THE SETTING TO BE RESTORED.

P. AIR BALANCING:

i. PRE-CONSTRUCTION AIR TESTING: MEASURE PRESSURE, TEMPERATURE, AND VOLUME OF AIR FROM EXISTING BASE BUILDING SYSTEM BEFORE STARTING WORK. TRAVERSE MAIN SUPPLY AND RETURN DUCTS BEFORE WORK TO OBTAIN TOTAL FLOW. SUBMIT REPORT TO ENGINEER IMMEDIATELY AFTER COMPLETION OF TEST.

ii. HVAC CONTRACTOR SHALL ENSURE THAT A FIRST SET OF AIR FILTERS ARE IN PLACE, WHENEVER FANS ARE RUNNING AND REPLACED WITH A NEW CLEAN SET OF FILTERS BEFORE TESTING IS COMMENCED.

iii. TEST, ADJUST, REPLACE SHEAVES, AND BALANCE ALL EQUIPMENT AND AIR DISTRIBUTION SYSTEMS TO PROVIDE AIR QUANTITIES INDICATED ON PLANS WITHIN PLUS OR MINUS 5 PERCENT.

iv. TEST REPORT SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

a) FLOW, LEAKAGE CLASS, TEMPERATURE, STATIC PRESSURE OF AIR AT ALL TRUNK DUCTS SERVING AREAS OF WORK.

b) TEMPERATURE OF AIR LEAVING OUTLETS AT TWO (2) TYPICAL AIR OUTLETS.

c) QUANTITY OF AIR AT EACH AIR INLET AND OUTLET AFTER BALANCING.

d) PROVIDE FOR ALL FANS, FAN MOTOR HP, AMPS, VOLTS, FAN RPM, CFM, INLET AND DISCHARGE STATIC PRESSURE, SHEAVE POSITION.

e) PROVIDE FOR ALL AIR CONDITIONING UNITS, SUPPLY CFM, OUTSIDE AIR CFM, RETURN AIR CFM, MIXED AIR CFM. PROVIDE OUTSIDE AIR, MIXED AIR AND SUPPLY AIR TEMPERATURES (DRY BULB - COOLING AND HEATING, WET-BULB-COOLING.) INDICATE UNIT OPERATING MODE DURING TEST.

f) CALIBRATE ALL NEW TERMINAL BOXES (VAV) AS REQUIRED TO MEET SPECIFIED MINIMUM/MAXIMUM CFM.

g) LISTING OF DESIGN AND ACTUAL READINGS AS WELL AS ALL MANUFACTURER'S DATA FOR EQUIPMENT.

12. INSULATION - GENERAL REQUIREMENTS

A. ALL INSULATION MATERIALS, INCLUDING JACKETS, FACING, ADHESIVE, COATINGS, AND ACCESSORIES ARE TO BE FIRE HAZARD RATED AND LISTED BY UNDERWRITERS LABORATORIES, INC. USING STEINER TUNNEL TEST METHOD FOR FIRE HAZARD CLASSIFICATION OF BUILDING MATERIALS, STANDARD UL 723 (ASTM E-84), (ASA A2.5-1963). FLAMESPREAD: MAXIMUM 25. FUEL CONTRIBUTED AND SMOKE DEVELOPED: MAXIMUM 50. FLAMEPROOFING TREATMENTS SUBJECT TO DETERIORATION FROM MOISTURE OR HUMIDITY ARE NOT ACCEPTABLE.

B. PRODUCTS SHALL NOT CONTAIN ASBESTOS, LEAD, MERCURY, OR MERCURY COMPOUNDS.

C. DEFINITIONS:

i. EXPOSED: INDOOR DUCTS, PIPING OR EQUIPMENT LOCATED IN MECHANICAL EQUIPMENT ROOMS AND IN AREAS WHICH WILL BE VISIBLE WITHOUT REMOVING CEILINGS OR OPENING ACCESS PANELS.

ii. CONCEALED: INDOOR DUCTS, PIPING OR EQUIPMENT WHICH IS NOT EXPOSED.

iii. OUTDOOR: DUCTS, PIPING OR EQUIPMENT WHICH IS EXPOSED TO THE WEATHER.

13. DUCTWORK INSULATION

A. INSULATE ALL DUCTWORK IN ACCORDANCE WITH INSULATION SCHEDULE ON M-600 DRAWING EXCEPT AS OTHERWISE NOTED.

B. REINSULATE ALL DUCTWORK AND PIPING WHICH IS EXISTING AND DAMAGED DURING CONSTRUCTION OR REQUIRED TO BE RELOCATED. INSULATE WITH SAME MATERIAL AND THICKNESS.

C. NON-INSULATED DUCTWORK:

i. WHERE SOUNDLINING IS OF MINIMUM THICKNESS SPECIFIED FOR INSULATION.

ii. AIR CONDITIONING RETURN AIR DUCTWORK EXPOSED IN AIR CONDITIONED SPACES AND INSTALLED IN HUNG CEILINGS WHERE SPACE IMMEDIATELY ABOVE AND BELOW ARE BOTH AIR CONDITIONED.

D. MATERIAL:

i. TYPE D-1: MINIMUM 1-LB DENSITY FIBERGLASS BLANKET, MAXIMUM 0.28 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY-APPLIED FOIL-SKRIM-KRAFT FACING SIMILAR TO MANVILLE MICROLITE.

ii. TYPE D-2: 3 LB. FIBERGLASS BOARD. THE MAXIMUM K FACTOR SHALL BE 0.23 AT 75°F MEAN TEMPERATURE WITH A MINIMUM DENSITY OF 3 LB. THE INSULATION SHALL BE PROVIDED WITH A FACTORY-APPLIED ALL PURPOSE OR ALL SERVICE FACING. THE INSULATION SHALL BE EQUAL TO MANVILLE TYPE 814 SPIN-GLAS AP.

iii. TYPE D-3: MINIMUM 6 LB FIBERGLASS BOARD. MAXIMUM 0.22 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY APPLIED ALL PURPOSE OR ALL SERVICE FACING. SIMILAR TO MANVILLE 817 SPIN-GLAS AP.

E. INSTALLATION:

i. FIBERGLASS BLANKET: 2 INCH LAP STRIPS AT ALL SEAMS. SECURE BOTTOM OF ALL DUCTS OVER 24 INCH WIDE WITH MIN. 2 ROWS OF WELD PINS 12 INCH ON CENTER. SECURE ALL SEAMS WITH FOIL VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE.

ii. FIBERGLASS BOARD: SEAL JOINTS AND BREAKS IN FACING WITH 3 INCH WIDE TAPE TO MATCH FACING AND ADHERE WITH VAPOR SEAL ADHESIVE. APPLY 5 INCH WIDE TAPE AT CORNERS, WELD PINS ON TOP, SIDES AND BOTTOM.

14. PIPING INSULATION

A. INSULATE ALL PIPING IN ACCORDANCE WITH INSULATION SCHEDULE ON M-600 DRAWING EXCEPT AS OTHERWISE NOTED.

B. PIPING, VALVES AND FITTINGS TO BE INSULATED:

i. LOW TEMPERATURE PIPING SYSTEMS, 40 TO 100°F INCLUDING

a) CHILLED WATER SUPPLY AND RETURN.

b) CONDENSER WATER SUPPLY AND RETURN.

c) GLYCOL WATER SUPPLY AND RETURN.

d) CONDENSATE DRAIN PIPING.

ii. LOW TEMPERATURE HOT PIPING SYSTEMS, 100 TO 250°F INCLUDING

a) LOW TEMPERATURE HOT WATER SUPPLY AND RETURN.

b) LOW PRESSURE STEAM SUPPLY TO 15 PSIG.

c) LOW PRESSURE CONDENSATE RETURN, EXCEPT STEAM TRAPS AND TRAP ASSEMBLY AND RADIATION RUNOUTS CONCEALED IN RADIATION ENCLOSURES.

d) PUMPED CONDENSATE DISCHARGE.

C. MATERIAL

i. TYPE P-1: MINIMUM 4 LB DENSITY MOLDED FIBERGLASS, MAXIMUM 0.23 K-FACTOR AT 75°F MEAN TEMPERATURE WITH FACTORY-APPLIED FIRE-RETARDANT FOIL-SKRIM-KRAFT FACING. ALL SERVICE JACKET. SIMILAR TO OWENS-CORNING 650 ASJ.

ii. TYPE P-4: MINIMUM 1 LB DENSITY FIBERGLASS FITTING INSERTS, MAXIMUM 0.28 K-FACTOR AT 75°F MEAN TEMPERATURE SIMILAR TO MANVILLE HI-LO TEMP INSULATION INSERTS.

iii. TYPE P-6: MINIMUM 6 LB MOLDED FOAMED PLASTIC. MAXIMUM 0.27 K-FACTOR AT 75°F MEAN TEMPERATURE. MAXIMUM 0.17 PERMEANCE. SIMILAR TO ARMSTRONG ARMAFLEX II.

D. FINISH:

i. TYPE F-1: FITTING COVER, MOLDED WHITE PVC JACKET, UL CLASS 1, MAXIMUM PERMEANCE 0.05 SIMILAR TO MANVILLE ZESTRON.

ii. TYPE F-4: PVC JACKETING WITH MINIMUM 0.016 INCH WALL THICKNESS AND LONGITUDINAL JOINTS WITH LOCK SEAMS.

E. OUTDOOR PIPING:

i. FOR ALL PIPING, FITTINGS AND VALVES LOCATED OUTDOORS, INCREASE SCHEDULED INSULATION THICKNESS BY A MINIMUM OF 1 INCH AND PROVIDE F-4 FINISH. PROVIDE VAPORSEAL ON ALL OUTDOOR PIPES, VALVES AND FITTINGS SUBJECT TO CONDENSATION.

ii. COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL HEAT TRACING REQUIREMENTS AND PIPING LENGTH REQUIREMENTS. ELECTRICAL TO PROVIDE CABLING AND THERMOSTAT.

F. INSTALLATION:

i. BEFORE APPLYING INSULATION ALL PRESSURE AND LEAK TESTS SHALL BE COMPLETED AND APPROVED.

ii. ALL INSULATION SHALL BE BUTTED FIRMLY TOGETHER. PROVIDE 2 INCH LAMP STRIPS AT ALL SEAMS SECURED WITH ADHESIVE. USE VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE WHERE REQUIRED. STAPLES NOT PERMITTED. REFRIGERANT PIPING INSULATION SHALL HAVE MITERED FITTINGS.

iii. ALL INSULATION AND VAPOR BARRIERS SHALL BE CONTINUOUS PASSING THROUGH SLEEVES, HANGERS, ETC., OR OTHER OPENINGS. PROVIDE SADDLES OR SHIELDS FOR PROTECTION.

iv. INSULATION FOR STRAINERS OR OTHER FITTINGS OR ACCESSORIES REQUIRING SERVICING OR INSPECTION SHALL HAVE INSULATION REMOVABLE AND REPLACEABLE WITHOUT DAMAGE.

15. FIRE-RATED INSULATION SYSTEMS

A. FIRE-RATED BOARD: STRUCTURAL-GRADE, PRESS-MOLDED, XONOLITE CALCIUM SILICATE, FIREPROOFING BOARD SUITABLE FOR OPERATING TEMPERATURES UP TO 1700°F. COMPLY WITH ASTM C 656, TYPE II, GRADE 6. TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING BY A NRTL ACCEPTABLE TO AUTHORITY HAVING JURISDICTION. MANUFACTURERED BY JOHNS MANVILLE; SUPER FIRETEMP M.

B. FIRE-RATED BLANKET: HIGH-TEMPERATURE, FLEXIBLE, BLANKET INSULATION WITH FSK JACKET THAT IS TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING BY A NRTL ACCEPTABLE TO AUTHORITY HAVING JURISDICTION. MANUFACTURED BY JOHNS MANVILLE; FIRETEMP WRAP; FIREMASTER DUCT WRAP, 3M; FIRE BARRIER WRAP PRODUCTS, UNIFRAX CORPORATION; FYREWRAP.

C. NYC PROJECTS: PRODUCT SHALL HAVE LISTING FOR THE PARTICULAR APPLICATION

16. VIBRATION ISOLATION

A. FURNISH AND INSTALL ALL NECESSARY VIBRATION ISOLATORS, VIBRATION HANGERS, MOUNTING PADS, RAILS, ETC., TO ISOLATE VIBRATION AND SOUND FROM BEING TRANSMITTED TO THE BUILDING STRUCTURE. ALL VIBRATION PRODUCTS SHALL BE SPECIFICALLY DESIGNED FOR THEIR INTENDED USE. PROVIDE ISOLATION FOR MOTORIZED EQUIPMENT.

B. MANUFACTURER OF THE VIBRATION ISOLATION EQUIPMENT SHALL HAVE THE FOLLOWING RESPONSIBILITIES

i. SUBMIT TYPE, SIZE, DEFLECTION, LOCATION AND DETAILS INCLUDING FREE HEIGHT FOR EACH ISOLATOR PROPOSED FOR ITEMS IN THE SPECIFICATION AND ON THE DRAWINGS.

ii. SUBMIT DETAILS OF ALL STEEL FRAMES AND CONCRETE INERTIA BASES TO BE USED IN CONJUNCTION WITH THE ISOLATION IN THIS SPECIFICATION AND IN THE DRAWINGS.

iii. CLEARLY OUTLINE THE PROCEDURES FOR INSTALLING AND ADJUSTING THE ISOLATORS OR HANGERS.

iv. GUARANTEE THE SPECIFIED ISOLATION SYSTEMS DEFLECTION AND THAT A MINIMUM OF 90% EFFICIENCY WILL BE OBTAINED.

C. THE FOLLOWING ARE APPROVED MANUFACTURERS, PROVIDED THEIR SYSTEMS STRICTLY COMPLY WITH THE DESIGN INTENT FOR PERFORMANCE, DEFLECTION AND STRUCTURAL CAPACITY OF THIS SPECIFICATION.

I. MASON INDUSTRIES, INC., HAUPPAUGE, NY
II. VIBRATION MOUNTINGS & CONTROLS, INC., BLOOMINGDALE, NJ
III. AMBER BOOTH, HOUSTON, TX
IV. KINETICS NOISE CONTROL, INC

D. PROVIDE INSTALLATION INSTRUCTIONS, DRAWINGS AND FIELD SUPERVISION TO ASSURE PROPER INSTALLATION AND PERFORMANCE.

E. INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS INCLUDING THE LOAD AND SPRING STATIC DEFLECTION FOR EACH FLOOR OR CEILING HUNG ISOLATOR.

F. PROVIDE LEVELING DEVICES AND APPROVED RESILIENT DEVICES AS REQUIRED TO LIMIT EQUIPMENT AND PIPING MOTION IN EXCESS OF 1/4 INCH ISOLATORS SHALL HAVE CAPABILITY OF SUPPORTING EQUIPMENT AND PIPING AT A FIXED ELEVATION DURING INSTALLATION AND AT A SPECIFIED HEIGHT AFTER ADJUSTMENT.

G. ALL SPRINGS SHALL HAVE AT LEAST 50% ADDITIONAL LOAD CAPACITY ABOVE DESIGN

LOAD.

H. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE EQUIPMENT CANNOT SUPPORT POINT LOADS.

I. PROVIDE CORROSION PROTECTION FOR EQUIPMENT MOUNTED OUTDOORS. SPRING CORROSION RESISTANCE SHALL BE POWDER COATING OF THE SPRING WITH THE STEEL HOUSING HOT DIPPED GALVANIZED. ALL HARDWARE TO BE CADMIUM PLATED.

J. CENTRIFUGAL FANS

i. FLOOR MOUNTED AXIAL FANS, CABINET FANS, FAN SECTIONS, AIR HANDLING UNITS UTILIZE MASON TYPE SLF FREE STANDING SPRING OR EQUAL.

ii. CEILING HUNG UTILIZE MASON TYPE 30 N OR EQUAL.

iii. 3 HP AND LESS MOTOR TYPE B-1 BASE WITH SPRING ISOLATORS MASON TYPE SLF SPRING ISOLATORS OR EQUAL.

iv. 24 INCH DIAMETER AND UP, WITH UP TO 40 HP MOTOR-TYPE B-1 BASE WITH MASON TYPE SLF SPRING ISOLATORS OR EQUAL.

v. MOTOR SIZE - MINIMUM CONCRETE THICKNESS

a) 5 TO 15 HP - 6 INCHES

b) 20 TO 50 HP - 8 INCHES

K. FLOOR MOUNTING OF PACKAGED AIR CONDITIONING UNIT WITH INTERNAL ISOLATION FOR COMPRESSORS - NEOPRENE IN SHEAR - TYPE SUPER W- BRIDGE BEARING.

i. 50 PSI MAXIMUM LOADING. PROVIDE STEEL BEARING PLATE TO DISTRIBUTE LOAD WHERE REQUIRED.

L. ROOFTOP AC UNITS - SPRING ROOF CURB - TYPE RSC AND/OR DUNNAGE STEEL WITH TYPE SLR WITH VERTICAL LIMIT STOPS.

M. SUPPORT OF PIPING IN EQUIPMENT ROOMS AND WHERE EXPOSED ON ROOF

i. ALL WATER PIPING OUTSIDE OF SHAFTS WITHIN 50 FEET OF CONNECTED ROTATING EQUIPMENT TO BE SUPPLIED WITH ISOLATORS.

ii. HANGER ROD ISOLATORS (TYPE 30N) MOUNTINGS.

iii. INDOOR SUPPORTED PIPING ISOLATORS (TYPE SLR).

iv. VERTICAL RISER PIPING ANCHOR AND GUIDES (TYPE ADA).

N. FLOOR AND ROOF MOUNTING OF FACTORY ASSEMBLED AIR HANDLING UNITS, AIR CONDITIONING UNITS, HEAT EXCHANGERS AND CONDENSING UNITS, - SPRING ISOLATORS (ROOF MOUNTED EQUIPMENT TYPE SLR), OR (INDOOR EQUIPMENT TYPE SLF).

O. PROVIDE FLEXIBLE CONNECTIONS BETWEEN ALL FANS AND DUCTWORK (REFER TO DUCTWORK SECTION FOR SPECIFICATIONS).

17. PIPING - GENERAL REQUIREMENTS

A. COMPLETE WITH: PIPE, FITTINGS, VALVES, STRAINERS, MOTORIZED VALVE OPERATORS, HANGERS, SUPPORTS, GUIDE, SLEEVES, AND ACCESSORIES.

B. ALL ITEMS SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH THE LATEST EDITIONS OF THE FOLLOWING CODES AND STANDARDS:

i. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME).

ii. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).

iii. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).

iv. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (MSS).

C. GASKETS: ONE PIECE RING TYPE 1/16 INCH MINIMUM THICKNESS KLINGER C4400 ONLY (OR APPROVED EQUAL, SUBMIT FOR APPROVAL BEFORE USE).

D. WELDING

i. ALL WELDING SHALL BE DONE IN ACCORDANCE WITH ALL CODES APPLICABLE TO THE PARTICULAR SERVICE. 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.

ii. COMPLY WITH SECTION II, PART C OF THE ASME BOILER AND PRESSURE VESSEL CODE FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND FOR CHEMICAL ANALYSIS OF PIPE BEING WELDED.

iii. QUALIFY PROCESSES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX, “WELDING AND BRAZING QUALIFICATIONS”. COMPLY WITH PROVISIONS IN ASME B31 SERIES, "CODE FOR PRESSURE PIPING."

iv. WELDERS SHALL BE QUALIFIED FOR ALL REQUIRED PIPE SIZES, MATERIAL, WALL THICKNESS, AND POSITION IN ACCORDANCE WITH THE AMERICAN SOCIETY OF

MECHANICAL ENGINEERING (ASME) SECTION IX, BOILER AND PRESSURE VESSEL CODE. CERTIFY THAT EACH WELDER HAS PASSED AWS QUALIFICATION TESTS FOR WELDING PROCESSES INVOLVED AND THAT CERTIFICATION IS CURRENT.

v. COPIES OF THE CERTIFIED WELDER QUALIFICATION REPORTS SHALL BE MAINTAINED BY THE RESPONSIBLE WELDING AGENCY AND THE COMPANY PERFORMING THE WELDING, AND SHALL BE SUBMITTED TO THE OWNER AND/OR ENGINEER UPON REQUEST.

vi. ALL DEFECTIVE WELDS SHALL BE CHIPPED OUT AND REPAIRED AT NO COST TO THE OWNER, BASED ON PROCEDURE TO BE SPECIFIED AT THE TIME.

E. COPPER TUBE BRAZING

i. ALL BRAZING SHALL BE DONE IN ACCORDANCE WITH ALL CODES APPLICABLE TO THE PARTICULAR SERVICE. BRAZING FILLER METALS: AWS A5.8, BCUP SERIES, COPPER-PHOSPHORUS ALLOYS FOR JOINING COPPER WITH COPPER; OR BAG-1, SILVER ALLOY FOR JOINING COPPER WITH BRONZE OR STEEL.

ii. QUALIFY PROCESS AND OPERATORS IN ACCORDANCE WITH ASME BOILER AND PRESSURE VESSEL CODE, SECTION IX, “WELDING AND BRAZING QUALIFICATIONS”.

iii. BRAZERS SHALL BE QUALIFIED FOR ALL REQUIRED TUBE SIZES, MATERIAL, WALL THICKNESS, AND POSITION IN ACCORDANCE WITH THE AMERICAN SOCIETY OF MECHANICAL ENGINEERING (ASME), SECTION IX, BOILER AND PRESSURE VESSEL CODE.

iv. COPIES OF THE CERTIFIED BRAZER QUALIFICATION REPORTS SHALL BE MAINTAINED BY THE RESPONSIBLE BRAZING AGENCY AND THE COMPANY PERFORMING THE BRAZING, AND SHALL BE SUBMITTED TO THE OWNER AND/OR ENGINEER UPON REQUEST.

v. ALL DEFECTIVE BRAZEMENTS SHALL BE CHIPPED OUT AND REPAIRED AT NO COST TO THE OWNER, BASED ON PROCEDURE TO BE SPECIFIED AT THE TIME.

F. GASKETS

i. PIPE-FLANGE GASKET MATERIALS: SUITABLE FOR CHEMICAL AND THERMAL CONDITIONS OF PIPING SYSTEM CONTENTS. ASME B16.21, NONMETALLIC, FLAT, ASBESTOS-FREE, 1/8-INCH MAXIMUM THICKNESS UNLESS THICKNESS OR SPECIFIC MATERIAL IS INDICATED.

G. ALL PRESSURIZED HYDRONIC PIPING TO BE TESTED HYDROSTATICALLY TO 150 PSI OR 150% OF OPERATING PRESSURE, WHICHEVER IS GREATER, BUT NEVER EXCEED TEST PRESSURE ANSI B16.1 BASIS. TEST DURATION TO BE 2 HOURS WITH NO PRESSURE CHANGE CORRECTED FOR TEMPERATURE CHANGE. REPAIR OR REPLACE LEAKS OR

DEFECTS WITHOUT ADDITIONAL COST.

i. REFRIGERANT PIPING

a) TEST REFRIGERANT PIPING FOR TIGHTNESS AND LEAKS UNDER PRESSURE OR VACUUM - COORDINATE WITH MANUFACTURER REQUIREMENTS. THE DURATION OF EACH TEST SHALL BE TWENTY-FOUR (24) HOURS.

b) TEST JOINTS IN ACCORDANCE WITH ASHRAE 15-LATEST EDITION. THERE SHALL BE NO OBSERVABLE LEAKS OR CHANGES IN PRESSURE. IF EITHER IS OBSERVED, SEAL LEAKS, AND REPEAT TEST PROCEDURES

H. SYSTEM FILLING

i. SYSTEMS OR PORTIONS OF SYSTEMS TO BE TESTED SHALL HAVE PROVISIONS FOR FILLING, VENTING (AIR REMOVAL), DRAINAGE AND TEST PRESSURE CONNECTION.

ii. LIQUID USED FOR TESTING SHALL BE CLEAN CITY WATER MIXED WITH CHEMICALS SPECIFIED BY THE BASE BUILDING WATER TREATMENT CONTRACTOR. THE HVAC CONTRACTOR SHALL HIRE THE SERVICES OF THE BUILDING WATER TREATMENT CONTRACTOR AND PROVIDE ALL REQUIRED LABOR. PROVIDE TEMPORARY METERING AND MIXING DEVICES AS REQUIRED. THE HVAC CONTRACTOR SHALL OBTAIN ALL REQUIREMENTS FROM THE BUILDING MANAGEMENT.

I. FLUSHING AND CLEANING AND TREATMENT

i. AFTER COMPLETION OF HYDROSTATIC TESTS AND EMPTYING, PROVIDE LABOR FOR INITIAL FLUSHING, CLEANING, AND PASSIVATING IN ACCORDANCE WITH THE OWNER'S WATER TREATMENT SPECIFICATION. THE HVAC CONTRACTOR SHALL HIRE THE SERVICES OF THE BASE BUILDING WATER TREATMENT CONTRACTOR. COORDINATE WITH THE OWNER'S WATER TREATMENT COMPANY AND PROVIDE ALL SPECIFICATION REQUIREMENTS AND REQUIRED LABOR. COORDINATE ALL REQUIREMENTS WITH BASE BUILDING MANAGEMENT FOR BASE BUILDING VENDOR.

ii. PROVIDE ONE YEAR'S SUPPLY OF NECESSARY WATER TREATMENT CHEMICALS FOR NEW SYSTEM TO THE OWNER OR TENANT INCLUDING THE FOLLOWING:

iii. CLOSED SYSTEM TREATMENT (CHILLED WATER, SECONDARY WATER, CLOSED CONDENSER WATER AND HOT WATER). PROVIDE AGENTS TO REDUCE SCALE DEPOSITS, TO ADJUST PH AND TO INHIBIT CORROSION. TREATMENT SHALL NOT CONTAIN ANY CHROMATE'S OR OTHER TOXIC SUBSTANCES. USE PROPER CHEMISTRY TO PROVIDE BACTERIA COUNTS BELOW 10^3 COLONIES PER MILLILITER (AEROBIC & NON AEROBIC). PH LEVELS TO BE BETWEEN 7.0 AND 9.0.

CORROSION RATE TO BE LESS THAN 1/2 MILS/YEAR STEEL, 1/10 MILS/YEAR COPPER.

iv. OPEN SYSTEM TREATMENT (CONDENSER WATER) PROVIDE AGENTS TO REDUCE SCALE DEPOSITS, TO ADJUST PH AND TO INHIBIT CORROSION. TREATMENT SHALL NOT CONTAIN ANY CHROMATE'S OR OTHER TOXIC SUBSTANCES. USE PROPER CHEMISTRY TO PROVIDE BACTERIA COUNTS BELOW 10^5 COLONIES PER MILLIMETER (AEROBIC AND NON-AEROBIC). PH TO BE BETWEEN 7.5 AND 8.5. CORROSION RATES TO BE LESS THAN 1 MILS/YEAR -STEEL AND 1/10 MILS/YEAR COPPER.

J. PROVIDE DIELECTRIC FITTINGS WHERE DISSIMILAR METALS ARE TO BE JOINED.

K. HOT (WET) TAPS:

i. PROVIDE NEW HOT (WET) TAP CONNECTIONS INTO PIPING SYSTEMS AS INDICATED ON THE PLANS.

ii. PROVIDE ALL REQUIRED EQUIPMENT AND MATERIALS SUCH AS A TAPPING MACHINE, WELDING MACHINE, FULL PORTED VALVE AND A PRESSURE CONTAINING FITTING. VALVE AND PRESSURE FITTING TO BE RATED FOR THE WORKING PRESSURE OF THE PIPING SYSTEM.

iii. HOT TAP TO BE PERFORMED BY A QUALIFIED CONTRACTOR WHO IS SPECIALIZED IN PERFORMING THIS TYPE OF WORK. CONTRACTORS NAME SHALL BE SUBMITTED TO THE OWNER, OWNER'S REPRESENTATIVE, BUILDING MANAGEMENT AND ENGINEER FOR APPROVAL PRIOR TO COMMENCING WORK.

iv. HOT (WET) TAP COUPON IS TO BE TURNED OVER TO BUILDING MANAGEMENT.

L. DRAIN DOWN FOR NEW PIPING CONNECTION INTO EXISTING:

i. CONTRACTOR TO OBTAIN SCHEDULE AND COORDINATE WITH BUILDING MANAGEMENT FOR SYSTEM DRAIN DOWN AND CONNECTION INTO EXISTING BUILDING PIPING. ALL COSTS ASSOCIATED WITH DRAIN DOWN ARE TO BE INCLUDED AS PART OF BID.

M. ALL INSTRUMENTATION (PRESSURE GAUGES AND THERMOMETERS) SHALL BE RATED FOR THE SAME PRESSURE AND TEMPERATURE AS PIPING SYSTEM AND RATED SPECIFICALLY FOR THE SAME SERVICE AS THE PIPING. PRESSURE GAUGES ARE TO BE LIQUID FILLED WITH 1% ACCURACY. SELECT GAUGES AND THERMOMETERS SO THAT THE MID-POINT IS AT THE WORKING PRESSURE AND TEMPERATURE. INSTRUMENTS TO BE MANUFACTURED BY WEISS INSTRUMENT, MILJOCO CORPORATION OR APPROVED EQUAL.

i. PROVIDE THERMOMETERS IN PIPING AS INDICATED ON THE DRAWINGS AND AT

THE INLET AND OUTLET OF EACH HYDRONIC COIL, HEAT EXCHANGER AND PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL TEMPERATURE. THERMOMETERS TO BE ORGANIC LIQUID FILLED.

ii. PROVIDE PRESSURE GAUGES IN PIPING AS INDICATED ON THE DRAWINGS AND AT SUCTION AND DISCHARGE OF EACH PUMP AND AT INLETS AND OUTLETS OF EACH HYDRONIC COIL, HEAT EXCHANGER AND PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL PRESSURE.

N. PIPE SUPPORTS:

i. PROVIDE ADEQUATE SUPPORT FOR PIPE AND CONTENTS TO PREVENT SAGGING, VIBRATION, OR SWAYING AND ALLOW FOR EXPANSION AND CONTRACTION. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE STRUCTURE CANNOT SUPPORT POINT LOADS.

ii. HORIZONTAL PIPING TO BE SUPPORTED BY FORGED STEEL ADJUSTABLE CLEVIS TYPE HANGER. MAXIMUM SPACING AS FOLLOWS:

a) STEEL 1 INCH AND SMALLER: 6 FEET.

b) STEEL 1-1/4 INCH AND LARGER: 10 FEET.

c) COPPER 1 INCH AND SMALLER: 5 FEET.

d) COPPER 1-1/2 IN to 2-1/2 INCH: 8 FEET.

e) COPPER 3 INCH: 10 FEET.

f) PROVIDE ADDITIONAL SUPPORTS AT CHANGES IN DIRECTION, BRANCH PIPING AND RUNOUTS OVER 5 FEET AND CONCENTRATE LOADS DUE TO VALVES, STRAINERS AND OTHER SIMILAR ITEMS.

iii. ROD SIZE

a) PIPE 2 IN AND SMALLER: 3/8 IN

b) PIPE 2-1/2 IN TO 3 IN: 1/2 IN

c) PIPE 4 TO 8 IN: 3/4 IN

iv. VERTICAL PIPING:

a) BASE ELBOW SUPPORT WITH BEARING PLATE ON STRUCTURAL SUPPORT.

b) GUIDES AT EVERY SECOND FLOOR (SPACING NOT TO EXCEED 25 FEET).

c) TOP SUPPORT HANGER OR SADDLE IN HORIZONTAL CONNECTION WITH PROVISIONS FOR EXPANSION.

d) INTERMEDIATE STEEL RISER CLAMP SUPPORT BOLTED AND WELDED TO PIPE BEARING ON STRUCTURAL STEEL OR BEARING PLATE AT FLOOR.

e) FOR MULTIPLE PIPES, COORDINATE GUIDES, BEARING PLATES AND ACCESSORY STEEL.

O. VALVES - GENERAL REQUIREMENTS

i. VALVE PRESSURE AND TEMPERATURE RATINGS: NOT LESS THAN INDICATED AND AS REQUIRED FOR SYSTEM PRESSURES AND TEMPERATURES.

ii. VALVE SIZES: SAME AS UPSTREAM PIPING UNLESS OTHERWISE INDICATED.

iii. VALVE-END CONNECTIONS:

a) FLANGED: WITH FLANGES ACCORDING TO ASME B16.1 FOR IRON VALVES

b) FLANGED: WITH FLANGES ACCORDING TO ASME B16.5 FOR STEEL VALVES

c) FLANGED: WITH FLANGES ACCORDING TO ASME B16.24 FOR BRONZE VALVES.

d) SOLDER JOINT: WITH SOCKETS ACCORDING TO ASME B16.18.

e) THREADED: WITH THREADS ACCORDING TO ASME B1.20.1.

f) VALVE BYPASS AND DRAIN CONNECTIONS: MSS SP-45.

iv. GENERAL-DUTY VALVE APPLICATIONS: UNLESS OTHERWISE INDICATED, USE THE FOLLOWING VALVE TYPES:

a) SHUTOFF SERVICE EXCEPT STEAM: BALL, BUTTERFLY OR GATE VALVES.

b) SHUTOFF SERVICE, STEAM: GATE VALVES.

c) THROTTLING SERVICE EXCEPT STEAM: BALL, BUTTERFLY, PLUG VALVES.

d) THROTTLING SERVICE, STEAM: GLOBE VALVES.

v. INSTALL SHUTOFF DUTY VALVES AT EACH BRANCH CONNECTION TO SUPPLY MAINS, AT SUPPLY CONNECTION TO EACH PIECE OF EQUIPMENT, UNLESS ONLY

ONE PIECE OF EQUIPMENT IS CONNECTED IN THE BRANCH LINE. INSTALL THROTTLING DUTY VALVES AT EACH BRANCH CONNECTION TO RETURN MAINS, AT RETURN CONNECTIONS TO EACH PIECE OF EQUIPMENT, AND ELSEWHERE AS INDICATED.

vi. INSTALL CALIBRATED BALANCING VALVES IN THE RETURN WATER LINE OF EACH HEATING OR COOLING ELEMENT AND ELSEWHERE AS REQUIRED TO FACILITATE SYSTEM BALANCING.

vii. INSTALL SPRING LOADED CHECK VALVES AT EACH PUMP DISCHARGE AND ELSEWHERE AS REQUIRED TO CONTROL FLOW DIRECTION.

viii. THREADED CONNECTIONS ARE NOT TO BE USED FOR GLYCOL SYSTEMS.

18. REFRIGERANT SYSTEMS

A. PROVIDE ALL REFRIGERANT PIPING REQUIRED FOR A COMPLETE REFRIGERATION SYSTEM, WITH ALL VALVES, FITTINGS AND SPECIALTIES NECESSARY FOR SATISFACTORY OPERATION IN ACCORDANCE WITH ASHRAE STANDARD 15-LATEST EDITION AND ALL AUTHORITIES HAVING JURISDICTION. REFRIGERATION SYSTEM SHALL INCLUDE ALL REQUIRED ITEMS FOR CHARGING, DRAINING AND PURGING THE SYSTEM.

B. REFRIGERANT PIPING SHALL BE HARD COOPER, TYPE L OR ACR, ASTM B88 OR ASTM B 280, BRAZED.

C. JOINTS IN REFRIGERATION PIPING SHALL BE BRAZED.

D. REFRIGERANT PIPING SHALL BE OF THE SIZE AND NUMBER OF PIPES RECOMMENDED BY THE MANUFACTURER AND AS APPROVED BY THE ENGINEER.

E. HORIZONTAL PIPING OF THE COMPRESSOR SUCTION AND DISCHARGE LINES AND THE CONDENSER DISCHARGE LINES SHALL BE PITCHED A MINIMUM OF ½ INCH IN 10 FEET, IN THE DIRECTION OF REFRIGERANT FLOW. EACH SUCTION GAS VERTICAL RISER SHALL BE TRAPPED AT ITS EVAPORATOR WITH A TRAP AS RECOMMENDED BY THE COMPRESSOR MANUFACTURER.

F. INSTALL REFRIGERANT PIPING TO PREVENT EXCESSIVE OIL FROM BEING TRAPPED IN THE SYSTEM. ANY ADDITIONAL RISERS OR EQUALIZER LINES REQUIRED BY THE MANUFACTURER OF EQUIPMENT FOR THE PROPER SYSTEM OPERATION SHALL BE INSTALLED AS PART OF THIS CONTRACT. PROVIDE A FULLY PIPED OIL SEPARATOR FOR EACH REFRIGERANT SYSTEM AS PER MANUFACTURER'S RECOMMENDATIONS.

G. VALVES SHALL BE DESIGNED FOR REFRIGERANT SERVICE. SHUTOFF VALVES SHALL BE BRASS PACKLESS TYPE. UNIONS, FLANGED VALVES OR FITTINGS SHALL BE PROVIDED FOR DISCONNECTING EQUIPMENT, CONTROLS, ETC. FOR MAKING REPAIRS. PIPING SHALL BE RUN IN A SINGLE LAYER, WITH EACH LINE ISOLATED FROM ANOTHER TO PREVENT RUBBING. PROVISION SHALL BE MADE FOR EXPANSION AND CONTRACTION

OF PIPING. ALL PIPING PASSING THROUGH WALLS, PARTITIONS, ETC., SHALL BE FURNISHED WITH SLEEVES AS REQUIRED.

H. REFRIGERANT PIPING PASSING THROUGH RATED FLOORS OR DEMISING WALLS SHALL BE ENCLOSED IN A RIGID AND GAS-TIGHT CONTINUOUS FIRE-RESISTING PIPE DUCT OR SHAFT VENTED TO THE OUTSIDE, IN ACCORDANCE WITH ASHRAE STANDARD 15-LATEST EDITION. PIPE CONDUIT SHALL BE COPPER TUBE TYPE L WITH SOLDERED FITTINGS.

I. REFRIGERANT PIPING RUNNING THROUGH/ABOVE PUBLIC CORRIDORS SHALL BE INSTALLED WITHIN 1-HR RATED ENCLOSURE. UNLESS IT CONTAINS LESS THAN 10 POUNDS OF GROUP A-1 REFRIGERANT, ITS COMPLETE DISCHARGE INTO THE CORRIDOR WOULD BE LESS THAN 50% OF ITS RCL PER TABLE 1103.1 IN THE NYC AND IT IS INSTALLED AT LEAST 9' AFF.

J. SHAFTS CONTAINING REFRIGERANT PIPING SHALL NOT BE SHARED WITH ANY AIR DUCTWORK.

19. ELECTRICAL WORK

A. GENERAL:

i. ELECTRICAL POWER WIRING SHALL BE PROVIDED BY THE ELECTRICAL CONTRACT. CONTROL WIRING SHALL BE PROVIDED BY THE HVAC CONTRACT. CONTROL WIRING SHALL BE DEFINED AS ANY WIRING 120V AND BELOW INSTALLED FOR PURPOSES OTHER THAN PROVIDING PRIMARY ELECTRICAL POWER TO EQUIPMENT.

ii. MOTOR STARTERS AND VARIABLE FREQUENCY DRIVES (VFD) SHALL BE FURNISHED BY THE HVAC CONTRACTOR AND INSTALLED BY THE ELECTRICAL CONTRACTOR. REFER TO EQUIPMENT SECTION FOR VARIABLE FREQUENCY DRIVE SPECIFICATIONS.

iii. DUCT MOUNTED SMOKE DETECTORS, WHERE REQUIRED, SHALL BE PROVIDED BY AND WIRED BY THE ELECTRICAL CONTRACTOR, AND MOUNTED BY THE HVAC CONTRACTOR.

a) THIS CONTRACTOR SHALL INSTALL THE SMOKE DETECTOR SAMPLING TUBES IN THE DUCT AS COORDINATED IN THE FIELD.

b) THIS CONTRACTOR SHALL ASSIST THE ELECTRICAL CONTRACTOR IN TESTING THE DUCT-MOUNTED SMOKE DETECTION SYSTEM.

iv. ALL ELECTRICAL CONTROL WIRING SHALL COMPLY WITH LOCAL ELECTRICAL CODE, ALL AUTHORITIES HAVING JURISDICTION AND THE PROJECT ELECTRICAL SPECIFICATIONS.

v. MECHANICAL CONTRACTOR TO OBTAIN QUANTITY OF CONTROLLERS REQUIRED

AND COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL OPERATING REQUIREMENTS, INTERLOCKS AND CONNECTIONS FOR STARTERS.

vi. THE MECHANICAL CONTRACTOR SHALL PREPARE AND SUBMIT FOR APPROVAL POINT TO POINT, COMPLETELY COORDINATED WIRING DIAGRAMS AND INDICATE ALL SOURCE POWER REQUIREMENTS AND ALL FIELD WIRING TO BE PERFORMED BY THE ELECTRICAL CONTRACTOR.

vii. WHERE EXISTING STARTERS ARE TO BE REUSED, THIS CONTRACTOR SHALL MAINTAIN ALL EXISTING CONTROL CONNECTIONS. WHERE NEW STARTERS ARE TO BE PROVIDED TO REPLACE EXISTING, THIS CONTRACTOR SHALL SURVEY THE EXISTING CONTROL CONNECTIONS AND PREPARE AN EXISTING CONTROL WIRING DIAGRAM PRIOR TO DEMOLITION FOR SUBMITTAL TO THE ENGINEER. THE NEW STARTERS SHALL BE PROVIDED WITH THE NECESSARY CONTACTS AND RELAYS REQUIRED TO RECONNECT THE EXISTING CONTROLS. PROVIDE ALL REQUIRED CONTACTS FOR START/STOP AND FIRE ALARM.

20. MOTORS:

A. MOTORS SHALL HAVE THE ELECTRICAL CHARACTERISTICS AS LISTED ON THE DRAWINGS. COORDINATE ALL REQUIREMENTS WITH ELECTRICAL CONTRACTOR. ALL MOTORS SHALL COMPLY WITH NEMA MG-1 STANDARD AND SHALL BE OF THE HIGH EFFICIENCY TYPE AND MEET THE 1992 EPA ENERGY EFFICIENCY ACT AND UTILITY COMPANY REBATE REQUIREMENTS.

B. MOTORS FOR VARIABLE FREQUENCY DRIVES (VFD) SHALL BE SUITABLE FOR USE WITH VARIABLE FREQUENCY DRIVES AND COMPLY WITH NEMA MG-1 PART 31.40.4.2. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL REQUIREMENTS OF THE MOTOR AND VFD MANUFACTURER.

C. IF CONTRACTOR ELECTS TO SUBSTITUTE OR INCREASE MOTOR HORSEPOWER OVER THAT SPECIFIED, THE COST OF MOTOR AND ELECTRICAL CHANGES SHALL BE BORNE BY THIS CONTRACTOR.

D. MOTORS (UNDER HVAC WORK): IN ACCORDANCE WITH NEMA, IEEE AND ANSI C50 STANDARDS:

i. STANDARD EFFICIENCY UNLESS OTHERWISE NOTED.

ii. 1.15 SERVICE FACTOR INCLUDING MOTORS SERVED FROM A VFD

iii. SQUIRREL CAGE INDUCTION, OPEN DRIPPROOF TYPE, 1750 RPM, NEMA TYPE B INSULATION CLASS, CONTINUOUS DUTY, EXCEPT AS NOTED.

21. MOTOR CONTROLLERS

A. SUPPLIED BY HVAC CONTRACTOR AND INSTALLED AND WIRED BY ELECTRICAL

CONTRACTOR.

B. ENCLOSURES:

i. PROVIDE ENCLOSURES FOR STARTERS AND VFD'S SUITABLE FOR OPERATING ENVIRONMENT. ENCLOSURE'S SHALL BE NEMA 1 VENTILATED SHEETMETAL FOR INDOOR APPLICATION, NEMA 3R WITH ADDITIONAL GASKETING WEATHER-PROOF RAINTIGHT ENCLOSURE FOR EXPOSED OUTDOOR SERVICE OR INDOOR SERVICE EXPOSED TO MOISTURE. PROVIDE DISCONNECT SWITCH ON ENCLOSURE AS REQUIRED FOR SERVICE.

C. WITH SOLID-STATE (ELECTRONIC) OVERLOAD PROTECTION. COORDINATE ALL MOTOR CONTROLLER TYPES AND SIZES WITH MOTOR TYPES AND SIZES.

D. 1/3 HP AND SMALLER: PROVIDE MANUAL STARTER EXCEPT USE MAGNETIC TYPE WHERE AUTOMATICALLY CONTROLLED.

i. MANUAL TYPE: 2-POLE TOGGLE SWITCH WITH OVERLOAD PROTECTION AND PILOT LIGHT.

E. 1/2 HP AND LARGER: PROVIDE MAGNETIC STARTER:

i. COMBINATION UNFUSED DISCONNECT SWITCH AND MAGNETIC STARTER EXCEPT AS NOTED.

ii. SOLID-STATE (ELECTRONIC) OVERLOAD PROTECTION IN EACH PHASE LEG WITH RESET IN ENCLOSURE.

iii. HOA SELECTOR SWITCH FOR AUTOMATICALLY OPERATED MOTORS. SAFETY CONTROLS COMMON TO BOTH CONTROLS.

iv. RED, GREEN AND AMBER PILOT LIGHTS.

v. SWITCHES: HORSE-POWER-RATED, EXTERNAL PADLOCKING TYPE.

vi. HOLDING COILS: 10 WATT, 120 VOLT.

vii. CONTACTS: MAIN LINE AND MINIMUM (2) - NORMALLY OPEN, (2) - NORMALLY CLOSED 10 AMP AUXILIARIES, IN ADDITION TO CONTACTS

viii. REQUIRED FOR CONTROLS SPECIFIED.

ix. CONTROL TRANSFORMER: FOR MOTORS OVER 120 VOLTS, TO STEP DOWN CONTROL VOLTAGE TO 120 VOLTS; OF THE REQUIRED CAPACITY WITH FUSE AND GROUND CONNECTION ON VOLTAGE SIDE.

x. FUSES: SIMILAR TO BUSSMAN.

xi. RELAYS: TO SUPPLEMENT AUXILIARY CONTACTS IN CONTROLLER. MINIMUM 10 WATT COIL AND TWO 10 AMP CONTACTS.

xii. TERMINALS: SUITABLE FOR CONDUCTORS NOTED AND AS APPROVED.

F. DISCONNECT SWITCHES ARE PROVIDED BY THE ELECTRICAL CONTRACTOR IF NOT INTEGRAL WITH EQUIPMENT.

G. ACCEPTABLE MANUFACTURERS:

i. EATON/ CUTLER HAMMER.

ii. SQUARE D.

iii. ALLEN BRADLEY.

iv. ABB

22. EQUIPMENT

A. PROVIDE ALL EQUIPMENT AND ACCESSORIES OF THE SIZES AND CAPACITIES AS SCHEDULED AND AS INDICATED ON THE DRAWINGS.

B. INSTALL EQUIPMENT IN ACCORDANCE WITH APPROVED SHOP DRAWINGS, MANUFACTURERS INSTRUCTIONS AND ALL CODES AND REGULATIONS WHICH APPLY.

C. PROVIDE EQUIPMENT SUPPORTS AND/OR MOUNTINGS AS INDICATED ON THE DRAWING, IN VIBRATION SPECIFICATION AND AS FOLLOWS:

i. FLOOR MOUNTED EQUIPMENT - PROVIDE DIMENSIONS FOR A 4 INCH CONCRETE HOUSEKEEPING PAD WITH ALL REQUIRED WATERPROOFING TO THE CONSTRUCTION MANAGER.

ii. EQUIPMENT ON FLOOR STANDS - PROVIDE FLOOR STAND OF STRUCTURAL STEEL OR STEEL PIPES AND FITTINGS ATTACHED TO FLOOR.

iii. ROOF MOUNTED EQUIPMENT - PROVIDE PREFABRICATED ISOLATED ROOF CURB WITH INTEGRAL VIBRATION ISOLATORS.

iv. CEILING MOUNTED EQUIPMENT - PROVIDE SUPPORTS WITH APPROVED SUITABLE ANCHORS SUSPENDED DIRECTLY FROM BUILDING STEEL STRUCTURE.

v. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED TO ADEQUATELY SUPPORT THE EQUIPMENT LOAD.

vi. EQUIPMENT SHALL BE INSTALLED WITH VIBRATION ISOLATION, REFER TO

VIBRATION ISOLATION SECTION.

D. RIGGING

i. THIS CONTRACTOR SHALL SURVEY THE BUILDING AND VERIFY THE RIG PATH PRIOR TO PURCHASE OF EQUIPMENT. CONFIRM ALL EQUIPMENT FITS THROUGH ALL HALLWAYS, DOORS, ELEVATORS, WINDOWS, ETC. WITHOUT REQUIRING MAJOR ALTERATIONS TO THE EXISTING BUILDING CONDITIONS. ANY MODIFICATIONS TO EXISTING CONDITIONS SHALL BE REPAIRED OR REPLACED BY CONTRACTOR.

ii. THIS CONTRACTOR SHALL PROVIDE ALL REQUIRED RIGGING, HOISTING AND BRACING TO INSTALL THE EQUIPMENT AS INDICATED ON THE PLANS. THIS WORK SHALL BE PERFORMED BY AN INSURED CERTIFIED LICENSED RIGGING COMPANY THAT IS EXPERIENCED IN RIGGING EQUIPMENT OF THE TYPE INDICATED FOR THE AREAS SHOWN ON THE CONSTRUCTION DOCUMENTS. THIS CONTRACTOR SHALL SUBMIT RIGGING PLANS FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK.

iii. ALL PERMITS REQUIRED FROM THE AUTHORITIES AND AGENCIES INVOLVED TO PERFORM THE RIGGING ARE THE RESPONSIBILITIES OF THIS CONTRACTOR.

iv. ALL STRUCTURAL SUPPORTS, MODIFICATIONS OR ADDITIONS ARE TO BE SUBMITTED TO THE STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK. ALL SUPPLEMENTAL STRUCTURAL SUPPORTS, ELEVATOR CHARGES /MODIFICATIONS, BRACING AND PROTECTION REQUIRED FOR THE RIG IS THE RESPONSIBILITY OF THIS CONTRACTOR.

v. THE RIGGING CONTRACTOR SHALL HIRE AND PAY FOR ALL CHARGES AND SERVICES OF THE BUILDING ELEVATOR CONTRACTOR FOR THE RIGGING OF THE EQUIPMENT.

E. UP FRONT PURCHASE OF EQUIPMENT

i. THE CONTRACTOR SHALL SUBMIT A LIST OF LONG LEAD TIME ITEMS THAT WILL AFFECT THE SCHEDULE OF THE PROJECT IF NOT PURCHASED IMMEDIATELY UP FRONT AT THE START OF THE PROJECT. THE MECHANICAL CONTRACTOR SHALL SUBMIT PROPOSED MANUFACTURER AND LEAD TIMES FOR ALL PROJECT EQUIPMENT AT TIME OF PROJECT AWARD.

23. AUTOMATIC CONTROLS - GENERAL REQUIREMENTS

A. WORK INCLUDED

i. FURNISH AND INSTALL AS HEREIN SPECIFIED, A COMPLETE AUTOMATIC TEMPERATURE CONTROL SYSTEM. MANUFACTURER SHALL BE SUBMITTED WITH BID AND APPROVED BY ENGINEER BEFORE BID AWARD. THE ATC

CONTRACTOR SHALL BE AN INDEPENDENT CONTRACTOR NOT AFFILIATED WITH THE MECHANICAL CONTRACTOR.

ii. PROVIDE POWER FOR PANELS AND CONTROL DEVICES FROM A SOURCE DESIGNATED BY THE ELECTRICAL CONTRACTOR.

iii. COORDINATE INSTALLATION SCHEDULE WITH THE MECHANICAL CONTRACTOR AND GENERAL CONTRACTOR.

iv. FURNISH, MOUNT, AND WIRE ALL ASSOCIATED PANELS AND DEVICES FOR THE SYSTEM TO BE COMPLETELY OPERATIONAL REGARDLESS OF FUNCTION OR VOLTAGE, UNLESS OTHERWISE STATED.

B. SUBMITTALS

i. PRODUCT DATA: INCLUDE MANUFACTURER'S TECHNICAL LITERATURE FOR EACH CONTROL DEVICE INDICATED, LABELED WITH SETTING OR ADJUSTABLE RANGE OF CONTROL. INDICATE DIMENSIONS, CAPACITIES, PERFORMANCE CHARACTERISTICS, ELECTRICAL CHARACTERISTICS, FINISHES FOR MATERIALS, AND INSTALLATION AND STARTUP INSTRUCTIONS FOR EACH TYPE OF PRODUCT INDICATED.

ii. 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.

a) SCHEMATIC FLOW DIAGRAMS SHOWING FANS, COILS, DAMPERS, VALVES, AND CONTROL DEVICES.

b) WIRING DIAGRAMS: POWER, SIGNAL, AND CONTROL WIRING.

c) DETAILS OF CONTROL PANEL FACES, INCLUDING CONTROLS, INSTRUMENTS, AND LABELING.

C. QUALITY ASSURANCE

i. INSTALLER QUALIFICATIONS: A QUALIFIED INSTALLER WHO IS AN AUTHORIZED REPRESENTATIVE OF THE AUTOMATIC CONTROL SYSTEM MANUFACTURER FOR BOTH INSTALLATION AND MAINTENANCE OF UNITS REQUIRED FOR THIS PROJECT.

ii. COMPLY WITH ALL CURRENT GOVERNING CODES, ORDINANCES, AND REGULATIONS INCLUDING UL, NFPA, THE LOCAL BUILDING CODE, NEC, ETC.

iii. MATERIALS AND EQUIPMENT SHALL BE THE CATALOGUED PRODUCTS OF MANUFACTURERS REGULARLY ENGAGED IN PRODUCTION AND INSTALLATION

OF AUTOMATIC TEMPERATURE CONTROL SYSTEMS AND SHALL BE MANUFACTURER'S LATEST STANDARD DESIGN THAT COMPLIES WITH THE SPECIFICATION REQUIREMENTS.

24. SEQUENCE OF OPERATIONS:

A. SPLIT SYSTEM (VRF) SEQUENCE:

1) PROVIDE A 7-DAY PROGRAMMABLE THERMOSTAT (BY VRF MANUFACTURER) FOR EACH AIR HANDLER, WITH CAPABILITY FOR FAN TO BE ALWAYS ON OR IN AUTOMATIC MODE.

a) PROGRAMMABLE THERMOSTAT SHALL BE CAPABLE OF SETBACK CONTROLS, PROGRAMMED BY THE END USER, FOR 65°F AND 80°F IN WINTER AND SUMMER, RESPECTIVELY.

b) PROGRAMMABLE THERMOSTAT SHALL HAVE 5°F DEADBAND AND SETPOINT OVERLAP RESTRICTIONS

c) ALL UNITS TO BE CONNECTED TO CENTRALIZED CONTROLLER FOR MONITORING AND CONTROL.

2) PROVIDE ALL WIRING FROM CONDENSING UNITS TO RESPECTIVE AIR HANDLERS AND CENTRAL CONTROLLER.

3) FAN MODES:

IN ON MODE, FAN SHALL RUN CONTINUOUSLY. WHEN THE FAN STOPS, EACH ASSOCIATED MOTORIZED DAMPER SHALL CLOSE.

IN AUTOMATIC MODE, FAN SHALL ONLY ENERGIZE UPON A CALL FOR COOLING/HEATING.

4) UNIT MODES:

a) IN COOLING MODE, THE CONDENSER SHALL CYCLE (ON, OFF) TO MAINTAIN SETPOINT.

b) IN HEATING MODE, THE HEAT PUMP SHALL CYCLE (ON, OFF) TO MAINTAIN SETPOINT.

c) FOR UNITS SERVING SPACES WITH EXTERIOR DOORS: DOOR SWITCH SHALL TEMPORARILY SHUT DOWN RESPECTIVE AHU WHEN DOOR IS OPEN FOR MORE THAN 5 MINUTES. UPON DOOR CLOSING, SYSTEM SHALL RE-ENERGIZE.

d) FOR AHUS SERVING AMENITY SPACES, ASSOCIATED THERMOSTATS SHALL DEFAULT TO SETBACK TEMPERATURES DURING UNOCCUPIED HOURS.

B. TOILET EXHAUST FANS:

I. FAN SHALL BE CONTROLLED VIA A WALL MOUNTED SWITCH.

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 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.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Aluminum and Copper Conductors: Comply with NEMA WC 70

B. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW, UF, USE and SO.

C. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC, metal-clad cable, Type MC, mineral-insulated, metal-sheathed cable, Type MI, nonmetallic-sheathed cable, Type NM, Type SO and Type USE with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC
4. 3M; Electrical Products Division

5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper, Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway, Type XHHW, single conductors in raceway, Mineral-insulated, metal-sheathed cable, Type MI, Type SE or USE multiconductor cable.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC, Mineral-insulated, metal-sheathed cable, Type MI, Nonmetallic-sheathed cable, Type NM.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC, Mineral-insulated, metal-sheathed cable, Type MI, Nonmetallic-sheathed cable, Type NM.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway, Underground feeder cable, Type UF.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC, Mineral-insulated, metal-sheathed cable, Type MI, Nonmetallic-sheathed cable, Type NM.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC, Mineral-insulated, metal-sheathed cable, Type MI, Nonmetallic-sheathed cable, Type NM.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway, Underground branch-circuit cable, Type UF.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN, in raceway, Power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. 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.

C. Use pulling means including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 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."

3.5 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."

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. 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 visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:
    1. Test procedures used.
    2. Test results that comply with requirements.
    3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grounding systems and equipment

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 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.

2.2 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Copper-clad steel ground rods are the most common grounding electrode. See Evaluations for discussion on alternative materials. Sectional rods are used when electrodes longer than 10 feet are required.

B. Ground Rods: Copper-clad; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

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

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits

2. Lighting circuits
3. Receptacle circuits
4. Single-phase motor and appliance branch circuits
5. Three-phase motor and appliance branch circuits
6. Flexible raceway runs
7. Armored and metal-clad cable runs
8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Metal 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.

3.3 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 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. 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.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

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 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. Bond all communication ground bars to main electric ground bar using 4 AWG green insulated copper in conduit.

3.4 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

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, and at ground test wells. Make tests at ground rods before any conductors are connected.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems
2. Construction requirements for concrete bases

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Allied Tube & Conduit
    b. Cooper B-Line, Inc.; a division of Cooper Industries
    c. ERICO International Corporation
    d. GS Metals Corp.
    e. Thomas & Betts Corporation
    f. Unistrut; Tyco International, Ltd.
    g. Wesanco, Inc.
    h. Or approved equal
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. 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.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored 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 malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. 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.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC

4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit

5) Or approved equal

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC

6) Or approved equal

G. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

H. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

I. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

J. Toggle Bolts: All-steel springhead type

K. Hanger Rods: Threaded steel

2.2 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

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. 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 two-bolt conduit clamps.

D. 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.

3.2 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, as permitted in 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: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS 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 by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 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.

3.4 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 (20.7-MPa), 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.

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.

3.5 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. Touchup: Comply with requirements in Section 099113 "Exterior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings
2. Nonmetal conduits, tubing, and fittings
3. Metal wireways and auxiliary gutters
4. Nonmetal wireways and auxiliary gutters
5. Surface raceways
6. Boxes, enclosures, and cabinets
7. Handholes and boxes for exterior underground cabling

B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6

C. ARC: Comply with ANSI C80.5 and UL 6A

D. IMC: Comply with ANSI C80.6 and UL 1242

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum

F. EMT: Comply with ANSI C80.3 and UL 797

G. FMC: Comply with UL 1; zinc-coated steel

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Fittings for EMT:

a. Material: Steel

b. Type: Setscrew

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions were installed and including flexible external bonding jumper.

4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: 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.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ENT: Comply with NEMA TC 13 and UL 1653

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660

E. Continuous HDPE: Comply with UL 651B

F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Fittings for LFNC: Comply with UL 514B

I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, Type 12 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.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: Fiberglass polyester extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

D. Tele-Power Poles:

1. Material: Galvanized steel with ivory baked-enamel finish Aluminum with clear anodized finish.

2. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 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 or aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: Cast metal

2. Type: Fully adjustable

3. Shape: Rectangular

4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

5. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. 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.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep

L. Gangable boxes are allowed.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R, Type 4, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1, Type 3R, Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC, IMC
2. Concealed Conduit, Aboveground: GRC, IMC, EMT

3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried concrete encased
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, Type 4

B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT, ENT
2. Exposed, Not Subject to Severe Physical Damage: EMT
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
a. Loading dock
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units
c. Mechanical rooms
d. Gymnasiums / Event rooms
4. Concealed in Ceilings and Interior Walls and Partitions: EMT
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC
7. 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: 1/2-inch 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. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and applies in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg. F (49 deg. C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. 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.

C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. 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.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. 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 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. 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.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. 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.

N. 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.

O. 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.

P. 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.

Q. 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. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg. F (17 deg. C) and that has straight-run length that exceeds 25 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg. F (70 deg. C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg. F (86 deg. C temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg. F (70 deg. C) temperature change.
    d. Attics: 135 deg. F (75 deg. C) temperature change

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed 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 or LFNC in damp or wet locations not subject to severe physical damage.

T. 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 center of box unless otherwise indicated.

U. 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 the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. 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.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 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."

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.6 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 260533

SECTION 260544 - SLEEVES & SLEEVE SEALS FOR ELECTRICAL RACEWAYS & CABLING

PART 1 - GENERAL

1.1 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

2.1 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. 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.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The)
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.
6. Or approved equal

C. Sealing Elements: EPDM, Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

D. Pressure Plates: Carbon steel.

E. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements.

2.3 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.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Presealed Systems
   b. Or approved equal

2.4 GROUT

A. Description: Non-shrink; 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 (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 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.

2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 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 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways
2. Identification of power and control cables
3. Identification for conductors
4. Underground-line warning tape
5. Warning labels and signs
6. Instruction signs
7. Equipment identification labels
8. Miscellaneous identification products

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI 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. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field

2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Comply with NFPA 70 and 29 CFR 1910.145.

D. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

E. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 7 by 10 inches.

F. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 10 by 14 inches.

G. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select 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

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands 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. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power
2. Power
3. UPS

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

D. 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. If field-applied color-coding is permitted, retain subparagraph below.
5. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.

2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.

b. Controls with external control power connections.

K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

L. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer and load shedding

M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Adhesive film label. 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.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less
2. Transient voltage suppression devices
3. Disconnecting and overcurrent protective devices
4. Instrumentation
5. Control power
6. Accessory components and features
7. Identification

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.
3. Include schematic and wiring diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 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 NEMA PB 2

C. Comply with NFPA 70

D. Comply with UL 891

1.6 WARRANTY

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

1. Warranty Period: Five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
2. All City Switchboard
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution
4. Siemens Energy & Automation, Inc.
5. Square D; a brand of Schneider Electric
6. Or approved equal

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Panel mounted
2. Branch Devices: Panel mounted
3. Sections front and rear aligned.

C. Nominal System Voltage: 208Y/120 V.

D. Main-Bus Continuous: As shown on the Drawings

E. Enclosure: Steel, NEMA 250, Type 1.

1. Enclosure Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
2. Enclosure: Flat roof; bolt-on rear covers for each section, with provisions for padlocking.

F. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

G. Space-Heater Control: Thermostats to maintain temperature of each section.

H. Space-Heater Power Source: 120-V external branch circuit.

I. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

J. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

K. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

L. Phase and Neutral Buses and Connections: Three phase, four wire unless otherwise indicated. Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.

1. Ground Bus: 1/4-by-2-inch-minimum size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors.

2. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.

3. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables.

M. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

N. Switchgear/switchboard height along with accessories (crown boxes, pull-boxes, conduit sweeps etc.) shall be coordinated with ceiling height and structural items in electrical room.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.

2. LED indicator lights for power and protection status.

3. Audible alarm, with silencing switch, to indicate when protection has failed.

4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device.

5. Transient-event counter set to totalize transient surges.

B. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase

C. Withstand Capabilities: 5000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

D. Protection modes and UL 1449 3rd. Edition SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 400 V for 208Y/120
2. Line to Ground: 400 V for 208Y/120
3. Neutral to Ground: 400 V for 208Y/120

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. 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. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    a. Instantaneous trip
    b. Long- and short-time pickup levels
    c. Long- and short-time time adjustments
    d. Ground-fault pickup level, time delay, and I^2t response
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.

2. Two-step, stored-energy closing.

C. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boltswitch, Inc.

b. Eaton Electrical Inc.; Cutler-Hammer Business Unit

c. Pringle Electrical Manufacturing Company, Inc.

d. Siemens Energy & Automation, Inc.

e. Square D; a brand of Schneider Electric

f. Or approved equal

2. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.

a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.

b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

3. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.

4. Service-Rated Switches: Labeled for use as service equipment.

5. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

6. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

E. Fuses are specified in Section 262813 "Fuses."

2.4 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install switchboards and accessories according to NECA 400.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "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 the full perimeter of concrete base.

2. For supported equipment, 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 switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Install spare-fuse cabinet.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard 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.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Switchboard will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

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

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. Include wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Field quality-control reports.

C. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 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 NEMA PB 1.

C. Comply with NFPA 70.

1.7 WARRANTY

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

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "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

b. Outdoor Locations: NEMA 250, Type 3R

c. Kitchen or Wash-Down Areas: NEMA 250, Type 4X

d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom

D. Phase, Neutral, and Ground Buses: Tin-plated aluminum

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum

2. Main and Neutral Lugs: Compression type

3. Ground Lugs and Bus Configured Terminators: Compression type

4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 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
5. Or approved equal

B. Panelboards: NEMA PB 1, power and feeder distribution type

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike

D. Mains: as indicated on the Drawings

E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 100 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 100 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Branch Overcurrent Protective Devices: Fused switches

2.3 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
5. Or approved equal

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: as indicated on the drawings.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 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
5. Or approved equal

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. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Handle Padlocking Device: Fixed attachment for locking circuit-breaker handle in on or off position.

e. Handle Clamp: Loose attachment for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. 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.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating 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 Section 260553 "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 Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. 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.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates
2. Weather-resistant receptacles
3. Tamper resistant receptacles
4. Snap switches and wall-box dimmers
5. Solid-state fan speed controls
6. Wall-switch and exterior occupancy sensors
7. Communications outlets

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

PART 2 - PRODUCTS

2.1 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; Division of Cooper Industries, Inc. (Cooper)
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell)
3. Leviton Mfg. Company Inc. (Leviton)
4. Pass & Seymour/Legrand (Pass & Seymour)
5. Or approved equal

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, 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.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES (TAMPER RESISTANT FOR UNITS)

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide the following:
   a. Cooper; 5351 (single), CR5362 (duplex)
   b. Hubbell; HBL5351 (single), HBL5352 (duplex)
   c. Leviton; 5891 (single), 5352 (duplex)
   d. Pass & Seymour; 5361 (single), 5362 (duplex)
   e. Or approved equal

2.4 GFCI RECEPTACLES (TAMPER RESISTANT FOR UNITS)

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A: (Tamper resistant in units)

1. Products: Subject to compliance with requirements, provide the following:
   a. Cooper; VGF20
   b. Hubbell; GFR5352L
   c. Pass & Seymour; 2095
   d. Leviton; 7590
   e. Or approved equal

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A.

1. Products: Subject to compliance with requirements, provide the following:
    a. Single Pole:
    b. Cooper; AH1221
        1) Hubbell; HBL1221
        2) Leviton; 1221-2
        3) Pass & Seymour; CSB20AC1
        4) Or approved equal
    c. Two Pole:
    d. Cooper; AH1222
        1) Hubbell; HBL1222
        2) Leviton; 1222-2
        3) Pass & Seymour; CSB20AC2
        4) Or approved equal
    e. Three Way:
    f. Cooper; AH1223
        1) Hubbell; HBL1223
        2) Leviton; 1223-2
        3) Pass & Seymour; CSB20AC3
        4) Or approved equal
    g. Four Way:
    h. Cooper; AH1224
        1) Hubbell; HBL1224
        2) Leviton; 1224-2
        3) Pass & Seymour; CSB20AC4
        4) Or approved equal

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide the following:
    a. Cooper; AH1221PL for 120 and 277 V
    b. Hubbell; HBL1201PL for 120 and 277 V
    c. Leviton; 1221-LH1
    d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V

e. Or approve equal

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide the following:

a. Cooper; AH1221L

b. Hubbell; HBL1221L

c. Leviton; 1221-2L

d. Pass & Seymour; PS20AC1-L

e. Or approved equal

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 RESIDENTIAL DEVICES

A. Telephone Outlet:

1. Products: Subject to compliance with requirements, provide the following:

a. Cooper; 3560-6

b. Leviton; 40649

c. Or approval equal

2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Products: Subject to compliance with requirements, provide the following

a. Cooper; 3562

b. Leviton; 40159

c. Or approval equal

2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

C. Tamper-resistant Convenience Receptacles: All 15A and 20A, 125 V convenience receptacles in residential areas shall be listed tamper resistant receptacle.

2.7 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.8 WALL PLATES

A. Single and combination types shall 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: Thermoplastic with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant while-in-use die cast metal bubble lockable cover.

2.9 FINISHES

A. 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.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. 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 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 right 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 devices that have been in temporary use during construction and that 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 (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by 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. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. 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.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. 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.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display 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 unacceptable.
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. 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.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches
2. Non-fusible switches
3. Receptacle switches
4. Shunt trip switches
5. Molded-case circuit breakers (MCCBs)
6. Enclosures

1.2 DEFINITIONS

A. NC: Normally closed

B. NO: Normally open

C. SPDT: Single pole, double throw

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.7 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.

PART 2 - PRODUCTS

2.1 FUSIBLE 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
5. Or approved equal

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. 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.
3. Lugs: Suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.2 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
5. Or approved equal

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. 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.

D. 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.
3. Lugs: Suitable for number, size, and conductor material.

2.3 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Ferraz Shawmut, Inc.
3. Littelfuse, Inc.
4. Or approved equal

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

2.4 MOLDED-CASE CIRCUIT BREAKERS

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
5. Or approved equal

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. 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.

D. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.5 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.
3. Kitchen or Wash-Down Areas: NEMA 250, Type 4X.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Section 260553 "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.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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.

C. 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.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

SECTION 264119 - LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide lightning protection system and related work in accordance with Contract Documents.

B. Scope of Work includes:

1. Provide early streamer emission (ESE) lightning protection system for building.

C. Related Work of other Sections:

1. Roof flashing
2. Non-metallic conduit
3. Surge Suppression
4. Grounding

1.2 QUALITY ASSURANCE

A. Codes: Comply with the Building Code of the State and standards listed.

B. Standards:

1. Underwriters Laboratories Inc.
    a. UL 96
2. Manufacturer’s Installation Standard
    a. HBP-21
3. The lightning protection system shall be designed by the engineering staff of the manufacturer of the equipment proposed to be installed.

C. Qualifications:

1. Installer’s Qualifications:
    a. The installation shall be made by or under the supervision of a licensed electrical contractor.

D. Certification:

1. Applied Research Laboratories (ARL) shall certify that the lightning protection system has been installed in accordance with the design and specification requirements.
    a. Applied Research Laboratories Inspection:
        1) Send completed ARL Certification Application Form to:

2) Applied Research Laboratories, 5371 N. W. 161st Street, Miami, FL 33014

b. Correction of Work: Areas indicating non-conformance with Manufacturer's Installation Standard HBP-21 shall be corrected by the installing contractor at no additional cost to the owner.

c. After completion of ARL inspection and acceptance, provide the owner with ARL Certification, Manufacturer's guarantee, warranty and $10,000,000 insurance coverage.

E. Testing:

1. A resistance-to-ground test of the completed system shall be performed using IEEE "Fall of Potential Method".

a. Resistance-to-ground reading shall not exceed 10 ohms.

1.3 SUBMITTALS

A. Submittal Package: Complete shop drawings showing the type, size and locations of all equipment, grounds and cable routings shall be submitted to the architect for approval prior to start of work.

B. Submit shop drawings and product data as specified below.

1. Shop Drawings: Detailed scale drawings of the complete system as proposed to be installed.

2. Product Data:

a. Catalog cut sheets and installation instructions

b. Bill of materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All equipment shall be new and the product of a single manufacturer as outlined herein.

B. Lightning protection system manufacturer shall be equal to:

1. Lightning Preventor of America T. 716-941-6145

2. Heary Bros. Lightning Protection Co., Inc.

C. Materials:

1. All materials for this installation shall be as defined by Underwriters Laboratories UL 96.

2. Copper shall be of the grade ordinarily required for commercial electrical Work, generally designated as being 98 percent conductivity when annealed.

a. Copper components shall not be used on aluminum surfaces.

3. Air terminal:
    a. Early Streamer Emission (ESE) air terminal
        1) 5/8” x 240” chrome plated copper
        2) Chrome plated copper support structure and sphere
        3) Threaded air terminal
4. Conductors:
    a. Copper Cable
        1) Copper 28 strands of 14 gauge copper ropelay wire, 115,000 circular mils, weighing not less than 375 lbs. per 1000 ft.
        2) The structural steel may be used in lieu of down conductors.
            a) Every other column or an average of 60’-0” intervals shall be bonded and connected to the ground system.
5. Attachments:
    a. Fasteners shall be of suitable configuration for the intended application and of the same material as the conductor. Nails, screws or bolts employed to secure the fasteners shall be stainless steel.
6. Connections and Splices:
    a. Connectors and splices shall be of suitable configuration and type for the intended application and of the same materials as the conductor.
7. Ground Rods:
    a. 3/4” x 10’-0” copper-bond ground rods with two-bolt copper ground rod clamp.
    b. One delta ground grid shall be installed for each down conductor.
    c. 24” x 24” x 20 gauge copper ground plates may be used in lieu of ground rods if soil conditions do not allow driving of ground rods.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the lightning protection system as required to obtain ARL certification.

B. The system shall consist of a mast-type system on the highest roof. The system shall include air terminal, mast, grounding cable, ground rods and splices.

C. Cables on roof shall be exposed and shall be fastened every 3’-0” max.

D. Downlead cables to ground rods shall be in 1” non-metallic conduit concealed within building construction.

E. Downlead cables shall not be brought directly through the roof. Conduit through pitch pockets or proper roof flashings shall be utilized for this purpose.

F. The roofing contractor shall furnish and install all proper roof flashings.

G. The electrical contractor shall furnish and install all necessary conduits for concealed down conductors.

H. Copper components shall not be connected to aluminum surfaces except by means of a bimetal connector.

3.2 COORDINATION

A. The lightning protection installer shall work with other trades to insure a correct, neat and unobtrusive installation.

B. A sound bond shall be made to the main water service, and to all other building grounding systems, including both telephone and electrical.

C. Proper surge arresters shall be installed on the power and telephone service by either the utility or the electrical contractor, as applicable.

D. Install surge arresters on electric service entrance secondary conductors.

3.3 INSPECTION AND LISTING LABORATORY

A. The installing contractor shall provide a videotape of the installation, including but not limited to; air terminal, mast mounting, bonding connections (waterline & structural steel), down conductors, ground rods/grids, test results and all buried, concealed or inaccessible connections and components.

1. The videotape and resistance-to-ground test results shall be forwarded to the lightning protection system manufacturer for review.

B. Upon completion of the installation, ARL shall inspect the installation (via videotape) for compliance with Manufacturer’s Installation Standard HBP-21.

END OF SECTION 264119

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts
2. Emergency lighting units
3. Exit signs
4. Lighting fixture supports

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.3 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

G. 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.

H. 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
2. Glass: Annealed crystal glass unless otherwise indicated.

I. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Section 233713 "Diffusers, Registers, and Grilles."

1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
2. Heat-Removal Units: Air path leads through lamp cavity.
3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
4. Dampers: Operable from outside fixture for control of return-air volume.
5. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.

2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A except Class B for T12/HO and T12/Slimline lamp ballasts
5. Total Harmonic Distortion Rating: Less than 10 percent
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better
7. Operating Frequency: 42 kHz or higher
8. Lamp Current Crest Factor: 1.7 or less
9. BF: 0.88 or higher
10. Power Factor: 0.95 or higher

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
1. Ballast Manufacturer Certification: Indicated by label.

D. Ballasts for Low-Temperature Environments: Electronic or electromagnetic type rated for 0 deg. F (minus 17 deg. C) starting and operating temperature with indicated lamp types.

E. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.

F. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
1. Dimming Range: 100 to 5 percent of rated lamp lumens
2. Ballast Input Watts: Can be reduced to 20 percent of normal
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

G. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
a. High-Level Operation: 100 percent of rated lamp lumens
b. Low-Level Operation: 30 percent of rated lamp lumens
2. Ballast shall provide equal current to each lamp in each operating mode.

3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A
4. Total Harmonic Distortion Rating: Less than 20 percent
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher
7. Lamp Current Crest Factor: 1.7 or less
8. BF: 0.95 or higher unless otherwise indicated
9. Power Factor: 0.95, except fixtures designated as "Residential" may use low-power-factor electronic ballasts or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
5. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg. F (Minus 30 deg. C) for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg. F (40 deg. C).
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg. F (Minus 29 deg. C) for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg. F (54 deg. C)
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A
5. Total Harmonic Distortion Rating: Less than 20 percent
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less
8. Power Factor: 0.90 or higher
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.

C. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg. C.

1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
2. Minimum Starting Temperature: Minus 40 deg. F (Minus 40 deg. C)

2.7 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Cooper Lighting, ES Series or equal
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    a. Battery: Sealed, maintenance-free, nickel-cadmium type
    b. Charger: Fully automatic, solid-state type with sealed transfer relay
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.8 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
    1. Battery: Sealed, maintenance-free, lead-acid type.
    2. Charger: Fully automatic, solid-state type with sealed transfer relay.
    3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
    7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

2.9 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500K, and average rated life of 20,000 hours unless otherwise indicated.

C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum)
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum)
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum)
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum)
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum)
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum)
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum)

2.10 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900K, and average rated life of 24,000 hours, minimum.

B. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "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. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. 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.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts
2. Luminaire-mounted photoelectric relays
3. Poles and accessories
4. Luminaire lowering devices

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CCT: Correlated color temperature

B. CRI: Color-rendering index

C. HID: High-intensity discharge

D. LER: Luminaire efficacy rating

E. Luminaire: Complete lighting fixture, including ballast housing if provided

F. Pole: Luminaire support structure, including tower used for large area illumination

G. Standard: Same definition as "Pole" above

1.4 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories

3. Details of installation and construction
4. Luminaire materials
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
6. Photoelectric relays
7. Ballasts, including energy-efficiency data
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions and finishes of poles
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles
12. Manufactured pole foundations

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
    1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
    3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
    4. Wiring Diagrams: For power, signal, and control wiring

C. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.

D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

E. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

F. Field quality-control reports.

G. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

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 IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires:Five years from date of Substantial Completion.

2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.

3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.

2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.

3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.

2. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

3. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. 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. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent
2. Specular Surfaces: 83 percent
3. Diffusing Specular Surfaces: 75 percent

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    a. Color: As selected from manufacturer's standard catalog of colors
    b. Color: Match Architect's sample of manufacturer's standard color
    c. Color: As selected by Architect from manufacturer's full range

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
    a. Color: As Per Architect/Interior Designer.

O. 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. "USES ONLY" and include specific lamp type.
    b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), 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) for fluorescent and compact fluorescent luminaires.
    e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
    f. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg. F and Higher: Electronic type rated for 0 deg. F starting and operating temperature with indicated lamp types.

2. Temperatures Minus 20 Deg. F and Higher: Electromagnetic type designed for use with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum
2. Sound Rating: Class A
3. Total Harmonic Distortion Rating: Less than 10 percent
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg. C, maximum
6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg. F and higher.

2.5 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg. F
3. Normal Ambient Operating Temperature: 104 deg F
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.

C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg. C.

1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
   a. Restrike Range: 105- to 130-V ac.
   b. Maximum Voltage: 250-V peak or 150-V ac rms.
2. Minimum Starting Temperature: Minus 40 deg F.

2.6 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), CCT color temperature 1900 K, and average rated life of 24,000 hours, minimum.

1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Low-Pressure Sodium Lamps: ANSI C78.43

C. Metal-Halide Lamps: ANSI C78.43 with minimum CRI 65 and CCT color temperature 4000 K

D. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65 and CCT color temperature 4000 K

E. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80 and CCT color temperature 4000K.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicate structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
    a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
    b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
    c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
    d. IESNA LM-64, "Photometric Measurements of Parking Areas."
    e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 265600