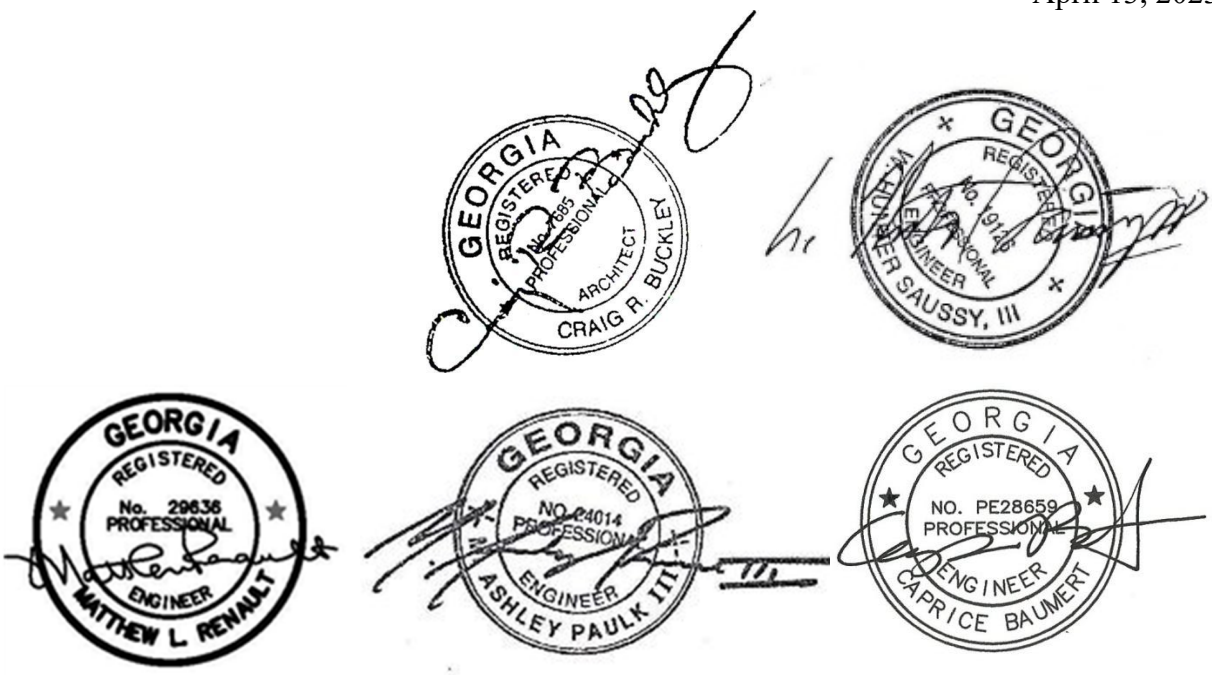
Project No. 21-036
Bid Set

Set No.

Strickland Arts and Cultural Center
Evans County, Georgia

Volume I of II

April 13, 2023



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

James W. Buckley & Associates, Inc.
7 East Congress Street, Suite 800
Savannah, Georgia 31401
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P R O J E C T M A N U A L
F O R
Strickland Arts and Cultural Center
Evans County, Georgia

OWNER:
Arts and Cultural Authority of Claxton & Evans County

ARCHITECTS:
James W. Buckley & Associates, Inc.
7 East Congress Street, Suite 800
Savannah, Georgia 31401
(912) 447-1080

CIVIL ENGINEER:
James W. Buckley, & Associates, Inc.
114 North Green Street
P.O. Box 727
Swainsboro, Georgia 31701
(478) 237-6467

STRUCTURAL ENGINEER:
Saussy Engineering.
400 E Johnny Mercer Blvd.
P.O. Box 30597
Savannah, Georgia 31410
(912) 898-8255

ELECTRICAL ENGINEER:
Electrical Design Consultants
1201 Broad Street
Suite 1A
Augusta, Georgia 30901
(706) 724-3551
Fax (706) 724-8507

MECHANICAL ENGINEER:
Delta Engineering Group, LLC
3604C Wheeler Road
Augusta, Georgia 30909
Office (706) 364-1770

Project No. 21-036

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STRICKLAND ARTS AND CULTURAL CENTER

Evans County, Georgia

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SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

B. Related Requirements:

1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Strickland Arts and Cultural Center.

B. Owner: Arts and Cultural Authority of Claxton & Evans County.

C. Architect: James W. Buckley & Associates, Inc., 7 East Congress Street, Suite 800, Savannah, Georgia, 31401.

D. Civil Engineer: James W. Buckley & Associates, Inc., 114 North Green Street, P.O. Box 727, Swainsboro, Georgia 30401.

E. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Structural Engineer: Saussy Engineering, 400E Johnny Mercer Blvd, P.O. Box 30597 Savannah Georgia, 31410.
2. Electrical Engineer: Electrical Design Consultants, 1201 Broad Street, Suite 1A, Augusta Georgia 30901.

3. Mechanical Engineer: Delta Engineering Group, LLC, 3604C Wheeler Road, Augusta, Georgia 30909.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. Before submitting a bid, each bidder will be responsible to make or obtain such explorations, tests and data concerning physical conditions (surface, subsurface and underground facilities) at or contiguous to the site, or otherwise may affect cost, progress, performance or furnishing of the work and which bidder deems necessary to determine its bid for performing and furnishing the work in accordance with the time, price and other terms and conditions of the Contract Documents.

B. The Work of Project is defined by the Contract Documents and consists of the following:

1. Renovation of a Historic School house into an arts center. The scope includes but not limited to Limited about of site work, interior renovation, HVAC, Plumbing and Electrical upgrades, and providing an elevator to make the building ADA Accessible.

C. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 ACCESS TO SITE

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

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to.
2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. Exterior work can proceed during day light hours after start of school. Contractor to provide protective fences as needed, and watchmen as needed, for public safety.

C. Confine operations to areas permitted under Contract.

1. Do not disturb portions beyond areas on which work indicated
2. Conform to site rules and regulations affecting work during construction period.
3. Contractor warn workmen (because of presence of students), loose, vulgar language not permitted.
4. Workmen required to wear shirts on school property.
5. Carefully place, watch work tools, ladders, hot tar kettles, other similar equipment to prevent injury to students and teachers.

D. Keep existing driveways, entrances serving premises clear, available to Owner, employees; do not use for parking, storage of materials.

E. Do not encumber site with materials or equipment.

F. Confine material stockpiling, location of storage sheds to areas indicated; if additional storage necessary, obtain, pay for storage off site.

G. Lock automotive vehicles (passenger cars, trucks, other mechanized, motorized construction equipment) when parked, unattended, to prevent unauthorized use; do not leave vehicles, equipment unattended with motor running, ignition key in place.

H. Clean Up: Work within project area and any off-site temporary facilities associated with the project shall be cleaned sufficiently on a daily basis to produce a neat appearance.

I. Controlled Substances: Use of tobacco products and other controlled substances within the proposed new building is not permitted.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

1.10 MISCELLANEOUS PROVISIONS

A. Cost of Testing – Responsibilities

1. Contractor Responsibilities:

a. The Construction Manager shall coordinate all testing activities.

2. Owner’s Responsibilities:

a. **Owner** to pay for services of independent agency, selected by contractor and approved by Architect/Engineer, to perform inspections and all other testing where specifically required through-out the contract documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 2100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Requirements:

1. Division 01 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

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

1.7 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

1. Contingency allowance $50,000.00 USD, Include within base bid.

END OF SECTION 01 2100

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Division 01 "Alternates" for products selected under an alternate.
2. Division 01 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION 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.

1. Substitution Request Form: Use facsimile of form provided in Project Manual.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within Five days Prior to bid. Architect will notify Contractor of acceptance or rejection of proposed substitution by Addendum only. Accepted products will be listed with in addendum and rejected products will not be listed

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 10 days prior to time required for preparation and review of related submittals.

1. 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:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution provides sustainable design characteristics that specified product provided.
c. Substitution request is fully documented and properly submitted.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: After bid not allowed.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 10 days prior to bid Requests received after that time may be considered or rejected at discretion of Architect.

1. 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:

a. 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.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Requested substitution provides sustainable design characteristics that specified product provided.

e. Substitution request is fully documented and properly submitted.
f. Requested substitution will not adversely affect Contractor's construction schedule.
g. Requested substitution has received necessary approvals of authorities having jurisdiction.
h. Requested substitution is compatible with other portions of the Work.
i. Requested substitution has been coordinated with other portions of the Work.
j. Requested substitution provides specified warranty.
k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

PRODUCT SUBSTITUTION CHECKLIST

Date: _____ Re: _____

A/E Number: _____ Manufacturer's Project No.: _____

Filing No.: _____ Contract For: _____

Product Equivalence:

☐ Is the submitted product equivalent to the specified item? _____

☐ Does it serve the same function? _____

☐ Does it have the same dimensions? _____

☐ Does it have the same appearance? _____

☐ Will it last as long? _____

☐ Does it comply with the same codes, and standards and performance requirements? _____

☐ Has the product been used locally, and where are the projects? _____

_____

☐ Has a problem occurred with the product, and what was the remedy? _____

_____

Effect on the Project:

☐ Will the substitution affect other aspects of the construction? _____

☐ Are any details affected and are changes required? _____

☐ What is the cost of the changes? _____

☐ Who pays for the required changes? _____

☐ Is construction time affected? _____

_____

Effect on the Warranty:

☐ How does the proposed warranty differ from the specified warranty? _____

_____

☐ Does the manufacturer have a track record of standing behind the warranty? _____

_____

SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification _____ Title: Description: _____

Article/Paragraph:

Section: _____ Page: _____ _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification _____ Title: ___ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E
☐ Other:

SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Division 01 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form included in Project Manual, “Field Order”

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within (5) Five Days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use “Proposal Worksheet Summary," and Form”Proposal Worksheet Detail." Sample copies are included in Project Manual.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use "Change Order Request (Proposal)," with attachments "Proposal Worksheet Summary," and "Proposal Worksheet Detail."Sample copy is included in Project Manual.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Division 01 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Division 01 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on form included in Project Manual.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Change Directive: Architect may issue a Construction Change Directive on form included in Project Manual. Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2600

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Division 01 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Division 01 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 01 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Key Personnel Names: Within 10 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: 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 to ensure maximum performance and 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. Environmental conditions: Coordinate construction schedule with all environmental conditions to allow the concrete to cure to meet the moisture requirements of each floor finish.

1. Temporary dry in, accelerated drying equipment and reclaiming work is part of this project and shall not be considered a change order.
2. Removal of excess moisture: It is the responsibility of the contractor to place the concrete slab at the specified water/cement ration, properly sure concrete slabs, limit exposure to moisture, dry-in the building in a timely fashion and render the building HVAC system operational in sufficient time to allow for the concrete slabs to dry sufficiently to allow for the application of the flooring.

    a. Should the concrete slab fail to meet the established maximum limits for moisture, the contractor shall be responsible for the implementation of necessary procedures to dry out the slab.
    b. Contractor responsible to cost for material, labor, and/or equipment required to dry out building sufficiently for installation of finished flooring systems.
    c. Contractor responsible for remedial application (ARDEX) to provide an acceptable substrate for finish flooring. Remedial work is part of base bid and not considered a change order.

3. Exterior Wall Systems:

    a. Prepare coordination drawings for integration of structural system with window wall system, solar screen, electrical work and HVAC work making up principal wall system.

C. 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.

D. 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.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings where installation is not completely shown on Shop Drawings, where limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on 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. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   c. Indicate required installation sequences.
   d. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
   e. As shown or required in individual specification sections
   f. Sheet size no smaller than 81/2’ x 11” and no larger than 30” x 42”

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

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

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

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

    a. Supplementary Drawings prepared by contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again
3. 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

    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. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. 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 seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

A. General: 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: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.

j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Preparation of record documents.
m. Use of the premises.
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules. And sequence of operations
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations. And site access
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.

u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 10 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for completing documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. 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.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site utilization.
        9) Temporary facilities and controls.
        10) Progress cleaning.
        11) Quality and work standards.
        12) Status of correction of deficient items.
        13) Field observations.
        14) Status of RFIs.
        15) Status of proposal requests.
        16) Pending changes.
        17) Status of Change Orders.
        18) Attic stock
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

B. Related Requirements:

1. Division 01 "Submittal Procedures" for submitting schedules and reports.
2. Division 01 "Quality Requirements" for submitting a schedule of tests and inspections.
3. Division 01 “Project management and Coordination” for Distributing meeting and conference reports

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragment; A partial or fragmentary network the breaks down activities in to smaller activities for greater detail

G. Major Area; a story of construction a separate building , a building wing, or a significant construction element

H. Milestone: a key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activates and activity relationships.

J. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, and two paper copies

B. Startup construction schedule.

1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at bi-weekly intervals.

G. Material Location Reports: Submit at Bi-weekly intervals.

H. Site / Field Condition Reports: Submit at Bi-weekly intervals.

I. Special Reports: Submit at time of unusual event.

1.5 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 30 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

a. Structural steel
b. HVAC Equipment
c. Elevator
d. Fenestrations

3. Startup and Testing Time: Include no fewer than 10 days for startup and testing. Of HVAC Equipment
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Mockups.
    b. Fabrication.
    c. Installation.
    d. Tests and inspections.
    e. Adjusting and Balance
    f. Curing.
    g. Building flush-out.
    h. Startup and placement into final use and operation.

5. Construction Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed or with the first pay request witch ever occurs first. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer completing, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.

    a. Approximate count of personnel for each sub-contractor

2. List of Visitors at Project site.

    a. AHJ- Authorizes having jurstrication
    b. Architect , Owner , Engineers
    c. Government agencies, Law enforcement , Dept of Home land , Dept of Labor.

3. Approximate count of general contractor's personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At Bi-weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for

Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within Two day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At Bi-Weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one Day before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 3200

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Division 01 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Division 01 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Division 01"Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Division 01“Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 SUBMITTAL REQUIREMENTS GENERAL

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

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.
    b. Deviations : Highlight, Encircle, or otherwise specifically identify devastations from the contract documents on submittals

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 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.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

1.5 SUBMITTTAL ADMINISTRATIVE REQUIRMENTS

A. Paper and Electronic Submittals: Place a permanent label or title block on each submittal item for identification.

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

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Name of subcontractor.
    f. Name of supplier.
    g. Name of manufacturer.
    h. 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., 061000.). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.A).

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

4. Transmittal for Paper and Electronic Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name of Contractor.
6) Name of firm or entity that prepared submittal.
7) Names of subcontractor, manufacturer, and supplier.
8) Category and type of submittal.
9) Submittal purpose and description.
10) Specification Section number and title.
11) Drawing number and detail references, as appropriate.
12) Transmittal number, numbered consecutively.
13) Submittal and transmittal distribution record.
14) Remarks.
15) Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. 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 with approval notation from Architect's action stamp.

D. 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.

E. Use for Construction: Retain complete copies of submittals on Project site. Use only final approved submittals .

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Action Submittals: Submit three paper copies and one electronic files of each submittal unless otherwise indicated. Architect will return one copies.
2. Informational Submittals: Submit two paper copies and one electronic files of each submittal unless otherwise indicated. Architect will not return copies.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

4. Drawings and Sketches over 11x 17 sheet size : Submit six (6) paper copies and one electronic files of each submittal unless otherwise indicated. Architect will return four copies.

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 published 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 catalog cuts.
    b. Manufacturer's Written recommendations.
    c. Manufacturer's Written installation instructions
    d. Manufacturer's product specifications.
    e. Color charts.
    f. Statement of compliance with specified referenced standards.
    g. Testing by recognized testing agency.
    h. Application of testing agency labels and seals.
    i. Mill reports
    j. Notation of coordination requirements.
    k. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

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. Identification of products.
b. Schedules.
c. Fabrication and Installation drawings
d. Rough-in and setting diagrams
e. Templates and patterns
f. Wiring Diagrams: Differentiate between manufacture and field installed
g. Design calculations
h. Seal and Signature of professional Engineer if required
i. Compliance with specified standards.
j. Notation of coordination requirements.
k. Notation of dimensions established by field measurement.
l. Relationship and attachment to adjoining construction clearly indicated.

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.

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 applicable Specification Section.
e. Specification paragraph number and generic name of each item.

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 one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

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 Five sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Sub-Contractor List; Prepare a written summary identifying individuals or firms proposed for each portion of the work, including those are to furnish products, or fabricated equipment to a special design . Include the following information in tabular form:

1. Name, address telephone number , and contact person
2. Number and Title of Specification section
3. Drawing number and Detail reference
4. Submit (5) Five copies
5. Mark up one copy and retain for “Project record Documents”

F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 "Project Management and Coordination."

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 "Quality Requirements."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Division 01 "Operation and Maintenance Data."

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

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

L. Installer Certificates: Submit 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.

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

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

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

P. Material Test Reports: Submit 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.

Q. Product Test Reports: Submit written reports indicating that 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.

R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

S. Preconstruction Test Reports: Submit 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.

T. Compatibility Test Reports: Submit 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.

U. Field Test Reports: Submit written reports 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.

V. Design Data: Prepare and submit 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.

2.2 DELEGATED-DESIGN SERVICES

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

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

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and Five paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: 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. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. 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. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. 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.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 3300

TRANSMITTAL

Project: _____ Date: _____

_____ A/E Project Number: _____

TRANSMITTAL A

To (Contractor): _____ Date: _____ Submittal No. _____

From (Subcontractor): _____ By: _____ ☐ Resubmission

Qty.	Reference / Number	Title / Description / Manufacturer	Spec. Section Title and Paragraph / Drawing Detail Reference

☐ Submitted for review and approval ☐ Substitution involved - Substitution request attached
☐ Resubmitted for review and approval ☐ If substitution involved, submission includes point-by-point comparative data or preliminary details
☐ Complies with contract requirements
☐ Will be available to meet construction schedule ☐ Items included in submission will be ordered immediately upon receipt of approval
☐ A/E review time included in construction schedule

Other remarks on above submission: ☐ One copy retained by sender

TRANSMITTAL B

To (A/E): _____ Attn: _____ Date Rec'd by Contractor: _____

From (Contractor): _____ By: _____ Date Trnsmt'd by Contractor: _____

☐ Approved ☐ Revise / Resubmit
☐ Approved as noted ☐ Rejected / Resubmit

Other remarks on above submission: ☐ One copy retained by sender

TRANSMITTAL C

To (Contractor): _____ Attn: _____ Date Rec'd by A/E: _____

From (A/E): _____ ☐ Other By: _____ Date Trnsmt'd by A/E: _____

☐ Approved ☐ Provide file copy with corrections identified
☐ Approved as noted ☐ Sepia copies only returned
☐ Not subject to review
☐ No action required ☐ Point-by-point comparative data required to complete approval process
☐ Revise / Resubmit
☐ Rejected / Resubmit
☐ Approved as noted / Resubmit ☐ Submission Incomplete / Resubmit

Other remarks on above submission: ☐ One copy retained by sender

TRANSMITTAL D

To (Subcontractor): _____ Attn: _____ Date Rec'd by Contractor: _____

From (Contractor): _____ By: _____ Date Trnsmt'd by Contractor: _____

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ One copy retained by sender

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. 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. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. 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.
3. 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.
4. Specific test and inspection requirements are not specified in this Section.

C. Related Sections Include the following:

1. Division 01” Construction progress Documentation” for a schedule of required testes and inspections.
2. Division 01 “Project Record Documents” for compiled testes and inspection reports for project close out
3. Divisions 01 though 49 for specific test and inspection requirements

1.3 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 constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

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

E. 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 specified requirements.

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

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

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

I. 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. Use of trade-specific terminology ie “plumber” in referring to a trade or entity does not imply that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: 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 conflicting 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.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

B. Testing Agency Qualifications: 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.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement weather conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement weather conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. 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.

E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

F. Testing and Inspection: include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

1.7 QUALITY ASSURANCE

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

B. 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.

C. 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.

D. 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.

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 is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections 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. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Contractors 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 329; and acceptable to owner/ Architect 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. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. 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.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. 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 seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow Ten days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

1.8 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 re-inspecting 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. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. The Owner will only be responsible for testing and inspections as listed within the "Statement of Special Inspections"
2. 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.
3. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
4. 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 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. 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.

F. 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.

G. 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.

H. 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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency and special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.
7. For each approved fabricator that is exempt from Special Inspections of shop fabrications and implementation procedures in accordance with Section 1704.2 of the Building Code, the Contractor shall submit “Fabricator’s Certificate of Compliance.” Contractor shall also provide copies of fabricator’s certification or building code evaluation services report and fabricator’s quality control manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 4100 - REGULATORY 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.

1.2 REGULATORY AGENCIES

A. Contractor responsible for notifying following agencies as to date that construction activities scheduled to commence:

1. Clerk of Superior Court in County in which project is to be constructed; "Notice of Commencement".
2. City or County Building Inspectors
3. EPA/EPD
4. Department of Natural Resources
5. Utility Companies
6. E-Verify

B. Contractor responsible for notifying following agencies as to date building is ready for preliminary and/or final inspection(s).

1. State Fire Marshal
2. Local Fire Marshal
3. City or County Building Inspectors

C. Inspection Reports:

1. Contractor shall send two copies of required notifications transmitted to Architect.
2. Contractor shall have all inspection reports sent directly to him with copies to Owner and Architect.
3. In event of inspection by one of above listed agencies not required, Contractor notify Owner and Architect in writing which agency and why not required to inspect building.

D. Forms:

1. Form of "Notice of Commencement" included at end of this Section.
2. Application for 80% preliminary and 100% final inspections by State Fire Marshal included at end of this Section.
3. Contractor obtain necessary forms from agencies required by respective agency.
4. Contractor Affidavit under O.C.G.A. 13-10-91, E-Verify (b) (1) Contractor
5. Contractor Affidavit under O.C.G.A. 13-10-91, E-Verify (b) (3) Sub-Contractor
6. Contractor Affidavit under O.C.G.A. 13-10-91, E-Verify (b) (4) Sub-Subcontractor

E. Fees and Costs:

1. Contractor pay all inspection fees required and performed by agencies having jurisdiction.

    a. Contractor responsible for fee payments until all contract related deficiencies corrected to satisfaction of inspecting agency.
    b. If non-contract related deficiencies exist, Contractor's responsibility not negated until all contract related deficiencies corrected.

2. Contractor responsible for costs associated with initial inspection and follow-up inspections (reinspections), when required, until all documented deficient work corrected and Occupancy Permit issued by all authorities having jurisdiction.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. Within 7 Calendar Days of Commencement of Construction activities; contractor shall transmit to Clerk of the Superior Court in county in which project is located, form of "Notice of Commencement".

B. In appropriate and timely manner and using applicable forms, notify authorities having jurisdiction that Project ready for required inspections.

1. Written notification required, indicating:

    a. Type inspection required.
    b. Stage of Project construction.
    c. Proposed date of inspection.
    d. Other requirements of specific agency or authority.

2. Transmit copy to Architect.

C. Contractor assists inspecting authority in performance of inspection.

1. Contractor’s project Manager and site Forman Accompany inspector until inspection complete.
2. Provide equipment required for inspections, including but not limited to:

    a. Flashlights.
    b. Mirrors.
    c. Ladders.
    d. Measuring devices.
    e. Other items required by specific inspection agency.

3.2 SUBCONTRACTS

A. The contractor or subcontractor shall insert in any subcontracts the clauses for providing Contractor Affidavit for E-Verify form and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in above and O.C.G.A. 13-10-91 Each company has to go on line, register and take knowledge test. Once this is done, you will receive company ID # https://e-verify.uscis.gov/emp

3.3 INSPECTION - STATE FIRE MARSHALL

A. Eighty (80%) Inspection:

1. Notify State Fire Marshall and request inspection upon completion of 80% of Project, providing minimum of 21 days notice.
2. 80% completion defined as having structural components in place and open for review of fire safety components such as:

    a. Fire walls.
    b. Vertical shafts.
    c. Stairways.
    d. Smoke stops.
    e. Hazardous area separation.
    f. Roof and ceiling assemblies.
    g. Corridor and door width.
    h. HVAC system.

3. Do not install ceilings or other obstructing elements until 80% inspection complete and acceptable.
4. Upon receipt of Fire Marshall's report, Contractor take following actions:

    a. Type Fire Marshall's hand written report.
    b. Review and respond in writing to each item in report indicating status of item, proposed method of resolution, and time resolution to finished.
    c. Transmit copies of report and response to Architect.
    d. Correct deficiencies indicated on report.

B. One Hundred (100%) Inspection:

1. Notify State Fire Marshall and request inspection upon completion of 100% of Project, providing minimum 21 days notice.
2. 100% completion defined building ready to occupy and qualify for Certificate of Occupancy.
3. Perform 100% inspection prior to occupancy of Project.
4. Upon receipt of Fire Marshall's report, Contractor take following actions:
    a. Type Fire Marshall's hand written report.
    b. Review and respond in writing to each item in report indicating status of item, proposed method of resolution, and time resolution to finished.
    c. Transmit copies of report and response to Architect.
    d. Correct deficiencies indicated on report.

C. Reinspection(s):

1. When documented deficiencies corrected, notify State Fire Marshall Project ready for reinspection.
2. Upon receipt of Fire Marshall's report, Contractor take following actions:

    a. Type Fire Marshall's hand written report.
    b. Review and respond in writing to each item in report indicating status of item, proposed method of resolution, and time resolution to finished.
    c. Transmit copies of report and response to Architect.
    d. Correct deficiencies indicated on report.

3. Repeat procedure until all deficiencies corrected and Occupancy Permit obtained.

END OF SECTION 01 4100

NOTICE OF COMMENCEMENT

TO THE CLERK OF THE SUPERIOR COURT OF _____ COUNTY, GEORGIA

Pursuant to O.C.G.A 44-14-361.5(b), the undersigned hereby gives Notice of Commencement of improvements to property including the following information:

1. Name, Address, and Telephone number of Contractor:

_____

_____

_____

2. Name and Location of Project:

_____

_____

A legal description of the property upon which the improvements are being made is attached hereto as
Exhibit "A", which is incorporated herein by this reference.

3. Name and address of true owner of property:

_____

_____

1. Name and address of person, other than true owner, at whose instance the improvements to the property are being made:

_____

_____

2. Name and address of Surety for the Performance and Payment Bonds, if any:

_____

_____

6. Name and address of Construction lender, if any:

_____

_____

_____

The Clerk of the County is requested to file, record and index, this Notice of Commencement, in the records and indices maintained for such notices.

_____
(Owner, Agent of Owner, Or Contractor)

Date _____

Contractor Affidavit under O.C.G.A. § 13-10-91(b)(1)

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services on behalf of (name of public employer) has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned contractor will continue to use the federal work authorization program throughout the contract period and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the contractor with the information required by O.C.G.A. § 13-10-91(b). Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____
Federal Work Authorization User Identification Number

_____
Date of Authorization

_____
Name of Contractor

_____
Name of Project

_____
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, ___, 20__ in _____(city), _____(state).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____, 20__.

_____
NOTARY PUBLIC

My Commission Expires:

_____

Subcontractor Affidavit under O.C.G.A. § 13-10-91(b)(3)

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract with (name of contractor) on behalf of (name of public employer) has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned subcontractor will continue to use the federal work authorization program throughout the contract period and the undersigned subcontractor will contract for the physical performance of services in satisfaction of such contract only with sub-subcontractors who present an affidavit to the subcontractor with the information required by O.C.G.A. § 13-10-91(b). Additionally, the undersigned subcontractor will forward notice of the receipt of an affidavit from a sub-subcontractor to the contractor within five business days of receipt. If the undersigned subcontractor receives notice of receipt of an affidavit from any sub-subcontractor that has contracted with a sub-subcontractor to forward, within five business days of receipt, a copy of such notice to the contractor. Subcontractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____
Federal Work Authorization User Identification Number

_____
Date of Authorization

_____
Name of Subcontractor

_____
Name of Project

_____
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, ___, 20__ in _____(city), _____(state).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____, 20__.

_____
NOTARY PUBLIC

My Commission Expires:

_____

Sub-subcontractor Affidavit under O.C.G.A. § 13-10-91(b)(4)

By executing this affidavit, the undersigned sub-subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract for (name of subcontractor or sub-subcontractor with whom such sub-subcontractor has privity of contract) and (name of contractor) on behalf of (name of public employer) has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned sub-subcontractor will continue to use the federal work authorization program throughout the contract period and the undersigned sub-subcontractor will contract for the physical performance of services in satisfaction of such contract only with sub-subcontractors who present an affidavit to the sub-subcontractor with the information required by O.C.G.A. § 13-10-91(b). The undersigned sub-subcontractor shall submit, at the time of such contract, this affidavit to (name of subcontractor or sub-subcontractor with whom such sub-subcontractor has privity of contract). Additionally, the undersigned sub-subcontractor will forward notice of the receipt of any affidavit from a sub-subcontractor to (name of subcontractor or sub-subcontractor with whom such sub-subcontractor has privity of contract). Sub-subcontractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____
Federal Work Authorization User Identification Number

_____
Date of Authorization

_____
Name of Sub-subcontractor

_____
Name of Project

_____
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.
Executed on _____, ___, 20__ in _____(city), _____(state).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____, 20__.

_____
NOTARY PUBLIC
My Commission Expires:

_____

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Division 01 "Project management and Coordination " for coordination of environment control .
2. Division 01 "Execution " for progress cleaning
3. Divisions 02 though 49 "For temporary heat , air-conditioning, ventilation , humidity control and indoor environment.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service:

1. Temporary service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
2. Permanent Service: Pay sewer-service use charges for sewer usage by all entities for construction operations. From date of commission though to date of owners move in Beneficial occupancy

C. Water Service:

1. Temporary service: Pay water-service use charges for water used by all entities for construction operations.
2. Permanent Service: Pay sewer-service use charges for Water usage by all entities for construction operations. From date of commission though to date of owners move in Beneficial occupancy

D. Electric Power Service:

1. Temporary service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
2. Permanent Service: Pay service use charges for Electric Powder usage by all entities for construction operations. From date of Permanent power commission though to date of owners Beneficial occupancy.

1.4 INFORMATIONAL SUBMITTALS

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

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

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.

C. Accessible Temporary Egress: Comply with applicable provisions in Georgia and federal ADA requirements and ICC/ANSI A117.1. and NFPA 241

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to 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. Chain-Link Fencing: Minimum 2-inch ,by 0.148-inch- 9 Gauge thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

B. Wood Enclosure Fence: Plywood, 6 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches

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.

F. Paint : Comply with Division 09 painting sections

2.2 TEMPORARY FACILITIES

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

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs,
3. Display mounted to wall necessary safety notices , emergency phone numbers permits , construction schedule , calendar, list of sub contractors and there contact information , contractors project managers and superintendent name and phone number .
4. Drinking water and private toilet.
5. Coffee machine and supplies.
6. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 73 deg F
7. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

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

1. Store combustible materials apart from building.

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. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 in front of each return-air grille in system and remove at end of construction. Replace temporary filter (In Front of grill) and filters within equipment every 30 days. In the event the filters are found to be beyond service the contractor shall clean the interior of the HVAC system prior to testing and balancing this shall be included with in base bid and is not a basis for change order.

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.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

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 requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities will not be permitted

E. Heating and Cooling and Humidity Control :Provide temporary heating and cooling required by construction activities for curing or drying of completed installations and 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.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Ventilation Provide temporary ventilation required by construction activities for installations or installing to eliminate 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

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

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

I. 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.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. superintendent cellular telephone number
f. Architect's office.
g. Engineers' offices.
h. Owner's office.
i. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

K. Electronic Communication Service: Provide wireless connection in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. 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 within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
2. Provide temporary traffic control facilities at junction of temporary roads with public roads, including warning signs for public traffic and "STOP" signs for access road entrance onto public roads. Comply with requirements and recommendations of local traffic authorities.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 "Asphalt Paving."

D. 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.

E. Parking: Use designated areas parking areas for construction personnel.
1. Parking of personal vehicles on the construction , next to work area shall not be allowed

F. 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 or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Access roads and parking.
b. Offices and first aid stations.
c. Sanitary facilities.
d. Telephones.
e. Emergency exits.
f. Fire protection facilities.
g. Barricades and obstructions.
h. Hazardous elements of construction work.

2. Maintain and touchup signs so they are legible at all times.

H. 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 progress cleaning requirements in Division 01 "Execution."
1. Contractor shall have a solid waste handling permit by rule issued by the Georgia Environment Protection Division complying with Section 391-3-4-.06(3)(a) of the Rules for Solid Waste management.

I. 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.

J. Temporary Elevator Use: Use of elevators is not permitted.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and specifications and “Georgia Soil and Water Conservation Commission”

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

E. Tree and Plant Protection: Comply with requirements specified and shown on drawings

F. 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. Perform control operations lawfully, using environmentally safe materials.

G. 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 required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

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

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. 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 incomplete, insulate temporary enclosures.

L. 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; manage fire-prevention program.

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 MOISTURE AND MOLD CONTROL

A. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and environmental control of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

C. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 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. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 "Closeout Procedures."

END OF SECTION 01 5000

SECTION 01 6000 - PRODUCT 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.

1.2 SUMMARY

A. 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; and comparable products.

B. Related Requirements:

1. Division 01 "Close out Procedures " for documentation of warranties
2. Division 01 "Project Management and coordination" for products selected and coordination of warranties.
3. Division 01 "Substitution Procedures" for requests for substitutions.
4. Division 01 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained 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 Substitution process 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. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. 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 seven (7) days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Division 01 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. 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. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 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.

B. Categories of Specific Warranties:

1. Warranties on work are in several categories, including those of General Conditions, and including (but not necessarily limited to) following specific categories related to individual units of work specified in sections of Divisions 2 through 49 of specifications:
2. Special Project Warranty (Guarantee):

    a. Warranty specifically written and signed by Contractor for defined portion of Work; and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor.

3. Specified Product Warranty:

    a. Warranty required by Contract Documents, provided for manufactured product incorporated into Work; regardless of whether manufacturer published similar warranty without regard for specific incorporation of product into Work, or has written and executed special product warranty as direct result of Contract Document requirements.

4. Coincidental Product Warranty:

    a. Warranty not specifically required by Contract Documents (other than as specified in this Section); but which is available on product incorporated into Work, by virtue of fact that manufacturer of product published warranty in connection with purchases and uses of product without regard for specific applications except as otherwise limited by terms of warranty.

C. Refer to individual sections of Divisions 2 through 49 for determination of units of work required to be specifically or individually warranted, and for specific requirements and terms of warranties (or guarantees).

D. General Limitations:

1. It is recognized that specific warranties intended primarily to protect Owner against failure of Work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources.
2. Except as otherwise indicated, specific warranties do not cover failures in Work which result from:

    a. Unusual and abnormal phenomena of elements.
    b. Owner's misuse, maltreatment of improver maintenance of Work.
    c. Vandalism after time of Final Acceptance.
    d. Insurrection or acts of aggression including war.

E. Related Damages and Losses:

1. In connection with Contractor's correction of failed warranted work, remove and replace other work of Project damaged as result of such failure, or must be removed and replaced to provide access or correction of warranted work.
2. Consequential Damages:

    a. Except as otherwise indicated or required by governing regulations, special project warranties and product warranties are not extended to cover damage to building contents (other than work of Contract) which occurs as result of failure of warranted work.

F. Warranty Periods:

1. All warranties begin on date of Substantial Completion for specified period of time from that date. See Division 01 " Close out procedures for requirements of "Substantial Completion "
2. No warranty period less than two years.
3. Where manufactures warranty begin at the date of material installation the contractor shall purchase the extended warranty and if not available warranty the product though his own forces

G. Reinstatement of Warranty Period:

1. Except as otherwise indicated, when work covered by special project warranty or product warranty failed and was corrected by replacement or restoration, reinstate warranty by written endorsement for following time period, starting on date of acceptance of replaced or restore work.

    a. Period of time equal to original warranty period of time.

H. Replacement Cost, Obligations: Except as otherwise indicated, costs of replacing or restoring failing warranted units or products is Contractor's obligation, without regard for whether Owner has benefited from use through portion of anticipated useful service lives.

I. Rejection of Warranties: Owner reserves right, at time of Final Acceptance or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner tend to detract from or confuse interpretation of requirements of Contract Documents.

J. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for materials or units or work for Project where special project warranty, specified product warranty, Coincidental Product Warranty, certification or similar commitment required,

1. Until determined that entities required to countersign such commitments are willing to do so.
2. The products ,systems, installations meet the minimum warranty requirements
3. Products, systems, installations allowed to be incorporated in the work without meeting the warranty requires becomes the responsibly of the contractor to provide the required warranty though own forces .

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

1.8 CERTIFICATES FOR MAJOR COMPONENTS

A. Certificates of Manufacturers shall be provided for major components

1. Major components as listed below and described on Section 02 tough 49

a. elevators, moving walks, dumbwaiters, escalators, lifts,
b. HVAC equipment 5 tons and over
c. HVAC and plumbing systems, e.g., cooling towers, compressors, condensers, absorption units, chiller units, fan coil units, air handling units, boilers, base mounted pumps, temperature controls, chemical feed systems, sewage pumps and water treatment systems, and incinerator systems.
d. Electrical , Occupancy sensors, Lighting control panel

B. Start-up, testing, and placing into operation shall be performed by the field representative(s) of the manufacturer(s), and certificate(s), of the manufacturer(s) shall be filed with the Owner on the letterhead(s) of the manufacturer(s) in which the manufacture(s) certifies of certify that “the equipment has been installed in strict compliance with the recommendations of the manufacturer(s), and is operating properly,” in the form enclosed at end of this section.

C. The manufacturer shall list in this certificate the item or items furnished to the job and the date, name, or other positive means of identifying any supplementary documents containing the recommendations of the manufacturer, with a copy of each of the supplementary documents attached to the certificate.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, 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 selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

D. Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 "Substitution Procedures" for proposal of product.

E. Match Existing Specification: Where Specifications require "match Existing ", or Match Existing in ever Respect" provide a product that complies with requirements and matches existing adjacent product and becomes indistinguishable to the existing . The product shall match in Size Shape, color shade , reflectance , pattern , texture density. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 "Substitution Procedures" for proposal of product.

2.2 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require 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. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

CERTIFICATE OF MANUFACTURER

INSTRUCTIONS FOR PREPARATIONS OF CERTIFICATE: To be acceptable, the certificate must be prepared in the form indicated by this specimen on the official letterhead of the manufacturer. No portions of the certificate may be omitted. The owner needs only two originals of the certificate. One in operational manual and one in warranty account (closeout). If the equipment of a manufacturer is not installed in strict compliance with the recommendations of the manufacturer, or if in the design of the work the equipment is not applied in strict compliance with the recommendations of the manufacturer, a letter from the manufacturer should be forwarded to the Contractor (with copies to the Design Professional and the Owner) setting forth a list of the deviations from the recommendations of the manufacturer and stating what remains to be done in order to bring the work into strict compliance with the recommendations of the manufacturer. Prior to calling upon the representative of the manufacturer for performance of the services necessary to enable him to execute a certificate in accordance with this specimen, it is the obligation of the Contractor to have installed the work in strict compliance with the recommendation of the manufacturer and it is likewise the obligation of the Contractor to have put the equipment good operating condition in absolute and final readiness for the "start-up," "testing," and "placing into operation" as defined herein below by the representative of the manufacturer.

Date: _____

Insert name and address of Owner

Re: Certificate of (JOHN DOE CORPORATION) that equipment of components furnished by it has (or have, as the case may be) installed in strict compliance with its recommendations and is (or are, as the case may be) operating properly at PROJECT NO. _____

Gentlemen:

1. We certify through our duty authorized and acting agent that the item (or items, as the case may be) furnished by us to the Project named in the caption was (or were as the case may be) started up, tested, and placed in operation by authorized field representative on (enter the date on which the field representative performed the start-up, test, and placing into operation) and is (or are, as the case may be) operating properly:

   (List the item or items furnished to the job. Show catalogue number or numbers.)

2. We certify further that the aforesaid equipment was installed in strict compliance with our recommendations as published by us in the following document (of documents, as the case may be):

   (Insert the date, name, or other positive means of identifying the exact document or documents in which the recommendations for installation and use of the item of items are published.) (*)

3. A copy of the aforesaid document(s) is (are) attached hereto.

   This_____ day of _____, 20_____

   JOHN DOE CORPORATION

   By: _____

   Authorized Representative

(*) The date must be shown

DEFINITIONS:

1. "Start-up" is defined as putting the equipment into action.
2. "Testing" is defined as performing such testing as is stipulated in the Contract Documents to be performed.
3. "Placing into operation" is defined as operating the equipment for a sufficient period of time for the determination to be made that it is performing properly.

WARRANTY OF GENERAL CONTRACTOR

OWNER: _____

JOB NAME: _____

PROJECT NUMBER: _____

ADDRESS: _____

COUNTY OF: _____ STATE OF: _____

DATE: _____

_____as General Contractor on the above project do hereby guarantee that all work executed under the plans and specifications will be free form defects of materials and workmanship for a period of:

Beginning at Substantial Completion Date and ending Two (2) YEARS from this date _____

and that all defects occurring within the warranty period shall be replaced or repaired at no cost to the Owner.

This guarantee covers all work as shown on the plans and specified in the Specifications and Contract Documents.

Nothing in the above shall be deemed to imply that this guarantee shall apply to any work which has been abused or neglected by the Owner.

Legal Name of Contractor:

_____

By: _____

Title: _____

_____
Notary Public

This _____day of _____, 20 _____.

My commission expires _____

WARRANTY BY SUBCONTRACTOR TO GENERAL CONTRACTOR

GENERAL CONTRACTOR: _____

SUBCONTRACTOR: _____

OWNER: _____

JOB NAME: _____

PROJECT NUMBER: _____

ADDRESS: _____

COUNTY OF: _____ STATE OF: _____

DATE: _____

Subcontractor on the above project do hereby guarantee that all work executed under the plans and specifications will be free form defects of materials and workmanship .

Beginning at Substantial Completion Date and ending Two (2) YEARS from this date _____

and that all defects occurring within the warranty period shall be replaced or repaired at no cost to the Owner.

This guarantee covers all work as shown on the plans and specified in the Specifications and Contract Documents.

Nothing in the above shall be deemed to imply that this guarantee shall apply to any work which has been abused or neglected by the Owner.

Legal Name of Subcontractor:

_____

By: _____

Title: _____

_____
Notary Public

This _____day of _____, 20 _____.

My commission expires _____

SPECIAL EXTENDED WARRANTY

OWNER: _____

JOB NAME: _____

PROJECT NUMBER: _____

ADDRESS: _____

COUNTY OF: _____ STATE OF: _____

DATE: _____

_____
(insert name of PRIME WARRANTOR above and circle appropriate source below)
As (SUPPLIER) (MANUFACTURER) (SUBCONTRACTOR) on the above referenced project for:

_____
(insert description of work or materials provided on the lines above)

and the General Contractor (co-signed below) do hereby guarantee that above executed under the criteria of the Contract Drawings and Specifications will be free form defect s of materials and workmanship for a period of _____ YEARS (Three years or more)

Beginning _____, and ending _____,
(Substantial Completion Date)

and that all defects occurring within the warranty period shall be replaced or repaired at no cost to the Owner. This warranty covers all work as shown on the Contact Drawings and Contract Specifications with warranty criteria outline in
Specification Section/Paragraph _____.
(insert the Technical Specification Section and Paragraph requiring the warranty)

Nothing in the above shall be deemed to imply that this guarantee shall apply to any work which has been abused or neglected by the Owner.

_____ Legal Name of Prime Warrantor
Legal Name of Contractor:

_____

By (Officer) By (Officer)

_____ _____
Title Title:

_____
Notary Public

This _____ day of _____, 20 _____.

My commission expires _____

HAZARDOUS MATERIALS CERTIFICATE

CERTIFICATE OF GENERAL CONTRACTOR

OWNER: _____

PROJECT NUMBER: _____

ADDRESS: _____

COUNTY OF: _____ STATE OF: _____

DATE: _____

_____as General Contractor on the above project do hereby certify that all materials, products, and assemblies supplied and installed in this project and in the site are totally free of asbestos, PCB, or other hazardous materials.

This certificate covers all materials required by contract documents.

Nothing in the above shall be deemed to imply that this guarantee shall apply to any work which has been abused or neglected by the Owner.

Legal Name of Contractor:

_____

By: _____

Title: _____

_____
Notary Public

This _____day of _____, 20 _____.

My commission expires _____

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Final As Built Survey
4. Installation of the Work.
5. Cutting and patching.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.

B. Related Requirements:

1. Division 01 “Project management & Coordination ‘ for procedures coordinating field engineering and other construction actives
2. Division 01 "Submittal Procedures" for submitting surveys.
3. Division 01 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Division 02 Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Registered land surveyor and professional engineer.

B. Certificates: Submit certificate signed by Registered land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

C. Certified Surveys: Submit two copies signed by Registered land surveyor or professional engineer.

D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

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

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.

f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: before beginning verify the existence and location of Site improvements and other utilities including construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to [**local utility**] [**Owner**] that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 FINAL AS BUILT SURVEY:

A. Engage a Registered Land Surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Contractor responsible for costs associated with survey.

B. Provide a detailed As-Built topographic and utility survey of sufficient detail and accuracy to verify compliance with contract provisions. The min. requirements for the survey shall include:

   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Locate all features required to show full compliance with contract documents. Locate horizontal features as follows:

      a. +/- 0.05' for building corners and line.
      b. +/- 0.10' for drainage and utility structures.
      c. +/- 0.10' for pavements, walks and other improvements.

   3. The topographic and utility survey shall meet following requirements:

      a. Grid: Maximum of 25'-0" grid.
      b. Contour Interval: Maximum 1'-0".

      Horizontal Datums: The Surveyor shall establish a coordinate system for the property. The property shall be calculated using State Plane Coordinate System utilizing Transverse Mecator Projection and North American Datum 1983 (NAD83). A minimum of two reference points shall be established. State Plane Coordinates, longitude & latitude, shall be shown on all property corners. Drawing coordinate system shall be based on state plane coordinates.
   4. Vertical Datum. Elevations shall be referenced to North American Vertical Datum of 1988 (NAVD88) in all cases where such datum has been established.

C. Survey data shall be furnished to the Architect utilizing both printed, hard copy and electronic file formats.

   1. Provide 1 original and 5 copies of survey on 30" X 42" sheets; each sheet containing an original surveyor's seal and signature.
   2. Provide two each CD Roms containing survey data on a Cad version which is fully compatible with Auto Cad Version 2007.

D. The topographic and utility survey shall be completed within thirty (30) calendar days of the completion of the site grading activities.

1. The contractor shall include the required time for the survey in his project time schedule.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

E. Engineer's Responsibilities: Upon receipt of survey data, the Civil engineer shall verify that grades, elevations, lines and inverts comply with the contract provisions. Should conditions not comply with contract requirements, the Engineer shall notify the contractor through the Architect of noted deficiencies.

F. Re-Survey Responsibility: Where results of required survey prove unsatisfactory and do not indicate compliance of related work with requirements of Contract Documents, then re-surveys are responsibility of Contractor, regardless of whether original survey was Contractor's responsibility.

1. The topographic and utility survey performed by the contractor shall be by the same surveyor and meet the same requirements as the original verification survey described above.

3.6 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
4. Post Installed Anchors in Concrete and Masonry :

    a. Only post installed mechanical expansion anchors, screw type concrete anchors and adhesive anchoring systems for use with threaded rod and reinforcing dowels with an ICC-ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria are allowed.
    b. Post installed anchors shall be approved to resist static, wind, and seismic tension and shear loads in cracked concrete.
    c. Anchors must be installed in accordance with the ICC–ES Report installation instructions or the manufacturer’s published installation instructions.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.7 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.8 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.9 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F .
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements with jurisdiction of project suite

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 "Quality Requirements."

3.11 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 7300

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Division 01 "Execution" for “As Built Site survey “and progress cleaning of Project site.
2. Division 01 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Division 01 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Division 01 "Demonstration and Training" for requirements for instructing Owner's personnel.
5. Division 02 though 49 for specific closeout and Special Cleaning and required Maintenance materials &Attic Stock

1.3 MAINTENANCE MATERIAL SUBMITTALS

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

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the dollar value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Authorities Having Jurisdiction: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Contractors warranty.
3. Sub-contractors warranty.
4. Special extended warranty.
5. Roof and wall bond.
6. Statutory affidavit.
7. Non-influence affidavit.
8. Contractor affidavit of payment debts and claims.
9. As built drawings
10. As built specifications
11. As built final property survey.
12. Record of testing and inspection.
13. Certificate of manufacture (all)
14. Test and balance reports.
15. Maintance manuals operation data.
16. Maintance supplies (attic stock).
17. Close out submission section 02 through 49. Specified in each section.
18. Advise owner of utilities change over.
19. Advise Owner of pending insurance changeover requirements.
20. Make final changeover of permanent locks and deliver keys to Owner.

C. Inspection: Submit a written request for inspection to determine 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.
3. Architect will provide (1) one inspection for substantial Completion
4. Contractor False Start: In the event that the contractor request an inspection for Substantial Completion, and the Architect determines that the work is not complete , ready for inspection it shall be deemed a false start. The contractor shall become liable for all delays, the Architect ,Architects Consultants , Owners and Owners Consultants expenses including , Salary ,Professional Fees, Travel Expenses , Accounting, Living Expenses and indirect expenses .

1.5 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01 2900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and

dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Architect will provide (1) one inspection for Finial Completion
3. Contractor False Start: In the event that the contractor requests an inspection for Final Completion, and the Architect determines that the work is not complete, ready for inspection it shall be deemed a false start. The contractor shall become liable for all delays, the Architect ,Architects Consultants , Owners and Owners Consultants expenses including , Salary, Professional Fees, Travel Expenses , Accounting, Living Expenses and indirect expenses .

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. PDF electronic file. and Three paper copies. Architect will return annotated file or one paper copy .

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: 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, or when delay in submittal of warranties might limit Owner's rights under warranty.

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

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

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

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

        1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

    p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Division 01 "Close out procedures " for coordinating operation and maintenance manuals
2. Division 01 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Division 01 "Project record documents" for verification and compilation of data into operation and maintenance manuals.
4. Divisions 02 though 49 for specific operation and maintenance manual requirements for each section

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format Electronic and Paper :

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION, AND MAINTENANCE MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: 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 and contact information for Contractor.
6. Name and contact information for Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

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

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

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

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

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

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. 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 storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

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

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

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

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.

7. System, subsystem, or equipment failure.
8. Chemical release or spill.
9. Instructions on stopping.
10. Shutdown instructions for each type of emergency.
11. Operating instructions for conditions outside normal operating limits.
12. Required sequences for electric or electronic systems.
13. Special operating instructions and procedures.

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

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

2.3 PRODUCT MAINTENANCE MANUALS

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 and drawing or schedule designation or identifier where applicable.

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

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

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

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

1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

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 and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

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

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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

G. 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.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

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.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

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.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

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.
2. Comply with requirements of newly prepared record Drawings in Division 01 "Project Record Documents."

F. Comply with Division 01 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Record Testing and reports
5. Miscellaneous record submittals.

B. Related Requirements:

1. Division 01 "Quality Requirements " Contractors warranty and Materials
2. Division 01 "Execution" for final property survey.
3. Division 01 "Closeout Procedures" for general closeout procedures.
4. Division 01 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints. and PDF electronic files of color scanned record prints

B. Record Specifications: Submit one paper copy and color scanned PDF of Project's Specifications, including addenda and contract modifications.

C. Record Testing and Inspections: Submit one paper copy and color scanned PDF of Project's Specifications, including addenda and contract modifications.

D. Record Product Data: Submit one paper copy of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy of each submittal.

F. Reports: Submit written report indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

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 provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

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

B. Format: Submit record Specifications as paper copy and color scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit miscellaneous record submittals as paper copy and color scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 TESTING AND INSPECTIONS RECORD SUBMITTALS

A. Assemble Material testing, inspections by authorizes having jurisdiction , special inspections. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as paper copy and color scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

2.5 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. Format: Submit miscellaneous record submittals as paper copy and color scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

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 revisions to project record documents as they occur; do not wait until 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 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

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.

A. Related Requirements:

1. Division 01 "Closeout Procedures" for coordinating closeout of the Contract.
2. Sections 02 though 49 for specific requirements for demonstration and training for products and systems

1.2 SUMMARY

A. 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 video recordings.

B. Provide onsite instructional sessions for Documentation, Maintenance, Adjustments, Emergencies, Repairs: listed below for all that apply Provide 2 copies to the owner.

1. Terrazzo
2. Resilient flooring
3. Carpet
4. Door hardware
5. All HVAC equipment
6. HVAC controls
7. Fire Alarm
8. Intrusion alarm system
9. Intercom system
10. TV system
11. CCTV system
12. Generator system
13. Backflow devices and meters
14. Sprinkler system
15. Sewage pump station system
16. Athletic surfacing
17. Athletic wood flooring
18. Wood flooring
19. Stage Curtains
20. Washer/dryers

21. Food Service Equipment
22. HVAC Motor controllers
23. Electric Water heaters
24. HVAC filter change for each equipment
25. Roof top units
26. Packaged Terminal Air-conditioning Units
27. Packaged Makeup Air Units
28. Power and Gravity Ventilators
29. Range Hood
30. HVAC control systems
31. Occupancy Sensors
32. Engine Generator System
33. Building Communication System
34. Fire Alarm System
35. Lighting control systems
36. A/V Systems
37.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and 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.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Contractor., Sub-Contractor & Sub-Sub-Contractor
e. Date of video recording.

2. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format as required Division 01 operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved , 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 for equipment not part of a system, as required by individual Specification Sections.

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 as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.

c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

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

B. 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.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

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.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. 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. Video: Provide minimum High definition video resolution converted to format file type acceptable to Owner, on electronic media.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Narration: Describe scenes on video recording by audio narration by microphone while or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.

E. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 7900

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SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.3 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.
4. Extent of selective demolition work indicated on Drawings and described herein.

1.4 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.5 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.6 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs (if applicable).
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations.

1. Submit before Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

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

1.8 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.9 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.10 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Loose furniture and other storage systems, all remaining furniture not removed shall become the responsibly of the contractor to depose of the cost of removal and disposal is to be included with in base bid.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.12 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 01 1000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 5000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 01 5000 "Temporary Facilities and Controls."

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area off-site.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SALVAGE ITEMS

A. The following are items to be salvaged

1. Salvaged items shall be placed on a pallet and tied down to the pallet and delivered to the owner’s maintenance yard.
2. Each item shall be given a number and tagged. the tag shall include the original location and item number

B. Salvage items

1. All HVAC units removed.
2. All refrigerant; Remove refrigerant from mechanical equipment to be selectively demolished. Owner will provide canisters to collect refrigerant. Label each canisters with type of refrigerant, DO NOT Mix refrigerant types.

3.7 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 4119

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

A. Provide all cast-in-place concrete, complete, in place, as indicated on the Drawings, specified herein and required for the complete installation.

1.3 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:
   1. Foundations and footings.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Submit 5 copies of laboratory test reports for concrete materials and mix design test. All concrete mix designs shall be prepared by a qualified testing laboratory.

D. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

E. Review Action: Submittals are reviewed for general conformance with the design concept only and are subject to all requirements of the contract documents. Contractor is responsible for dimensions, quantities and coordination with other trades. Reviews do not authorize any changes involving additional cost unless stated in separate letter or change order.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
   2. ACI 311.4R, AManual of Concrete Inspection.@
   3. ACI 318, "Building Code Requirements for Reinforced Concrete."
   4. ACI 304R, AGuide for Measuring, Mixing, Transporting and Placing Concrete.@
   5. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service:
   1. All testing services specified in this section of these specifications shall be performed by a recognized, independent laboratory approved by the Architect and Owner.
   2. The Contractor shall furnish to the testing agency samples of all proposed material to be used which requires testing.
   3. Testing agency shall check and review proposed materials to be used for compliance with these specifications, perform all testing in accordance with referenced standards and provide all reports.
   4. Contractor shall furnish all project specifications, testing material, mill reports, design mixes and cylinders, and shall notify laboratory of concrete pouring schedules so as not to delay progress of the work.
   5. No material or mixes shall be used on project unless approved by the Architect.
   6. Materials and installed work may require testing and retesting, as directed by the Architect, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times. Retesting of rejected material and installed work, shall be provided at the Contractor=s expense.

C. Tests for Concrete Materials:
   1. Portland cement shall be sampled and tested to determine the properties in accordance with ASTM C 150.
   2. Aggregates shall be sampled and tested in accordance with ASTM C 33 (normal weight).

D. Supervision: All reinforced concrete construction shall be performed under the personal supervision of the contractor=s superintendent. This superintendent shall keep a record of all concrete poured on the job. The record shall show in detail the area poured, the time and date of the pour and weather conditions which existed at the time of the pour. Upon completion of the work, this record shall be turned over to the Architect.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

B. Form Ties:
1. Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.
2. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Steel Wire: ASTM A 1064, plain, cold-drawn steel.

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
1. For slabs-on-grade, including thickened slab areas, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
3. For foundations, support reinforcing in bottom at footings with whole concrete bricks at 4'-0" on center.

2.3 CONCRETE MATERIALS

A. Portland Cement:
1. Comply with ASTM C 150, Type I.
2. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type F.

C. Normal-Weight Aggregates:
1. Comply with ASTM C 33 Class 4M and as specified. Provide aggregates from a single source for exposed concrete.
2. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
4. Do not use aggregates containing soluble salts, iron sulphide, pyrite, marcasite or ochre which can cause strains on exposed concrete surfaces.
5. Dune sand, bank run sand and manufactured sand are not acceptable.
6. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:
   a. Crushed stone, processed from natural rock or stone.
   b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.
   c. Maximum Aggregate Size: Not larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depths of slabs nor three-fourths of the

minimum clear spacing between individual reinforcing bars or bundles of bars nor over 1" in max. size except for block fill where max. size shall not exceed 2".

These limitations may be waived if, in the judgement of the Architect, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

D. Water: Potable.

E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixture:
1. Comply with ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Water-Reducing Admixture:
1. Comply with ASTM C 494, Type A.

H. High-Range Water-Reducing Admixture:
1. Comply with ASTM C 494, Type F or Type G.

I. Water-Reducing, Accelerating Admixture:
1. Comply with ASTM C 494, Type E.

J. Water-Reducing, Retarding Admixture:
1. Comply with ASTM C 494, Type D.

K. Calcium Chloride: Calcium chloride will not be permitted in concrete.

2.4 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
1. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:
1. Interior Concrete:
a. Formed Concrete: 4000 psi, 28-day compressive strength; 564 lbs. Cement per cubic yard minimum; non-air-entrained.
b. Slabs on Grade: 3000 psi, 28-day compressive strength; non-air-entrained.
c. Foundations: 3000 psi, 28-day compressive strength; non-air-entrained.

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
   1. Reinforced foundation systems: Not less than 1 inch and not more than 4 inches.
   2. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
   3. Concrete masonry grout: not less than 8 inches and not more than 11 inches.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work. No water shall be added to concrete mix at job site unless approved by Architect, except where indicated on delivery ticket that water has been withheld at batch plant and total amount of water does not exceed the total amount of mix water on the approved mix design.

2.5 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
   1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
      a. 4.5 percent (Exposure Class F1); 5.5 percent (Exposure Class F2) for 1-1/2-inch maximum aggregate.
      b. 4.5 percent (Exposure Class F1); 6.0 percent (Exposure Class F2) for 1-inch maximum aggregate.
      c. 5.0 percent (Exposure Class F1); 6.0 percent (Exposure Class F2) for 3/4-inch maximum aggregate.
      d. 5.5 percent (Exposure Class F1); 7.0 percent (Exposure Class F2) for 1/2-inch maximum aggregate.
   2. Other concrete not exposed to freezing and thawing (Exposure Class F0), or hydraulic pressure, or to receive a surface hardener. No air-entrainment. Maximum total air content shall not exceed 3 percent.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.6 CONCRETE MIXING

A. Job-Site Mixing:
   1. Mix concrete materials in appropriate drum-type batch machine mixer. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1 cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd.
   2. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mixed Concrete:
   1. Comply with requirements of ASTM C 94, and as specified.
   2. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

3.3 PLACING REINFORCEMENT

A. General:
   1. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during

concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.4 INSTALLING EMBEDDED ITEMS AND ANCHORS

A. General: Set and build into formwork 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.

3.5 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
   1. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Inspection: 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.

B. General: Comply with ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms:
   1. Deposit concrete in forms in horizontal layers no deeper than 24 inches 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.
   2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309R.
   3. 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 machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to 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 mix to segregate.

E. Placing Concrete Slabs:
   1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
   2. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
   3. Bring slab surfaces to correct level with a 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.
   4. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (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.
   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R and as specified.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 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. Using liquid nitrogen to cool concrete is Contractor's option.
   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 embedding in concrete.
   3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
   4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 MISCELLANEOUS CONCRETE ITEMS

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 specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

3.9 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:
   1. Keep concrete surface continuously wet by covering with water.
   2. Use continuous water-fog spray.
   3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:
1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.
1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.10 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Contractor will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.
1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
   b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
   e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to the Architect within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 03 3000

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SECTION 04 2000 - UNIT MASONRY ASSEMBLIES

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. Extent of each type masonry work indicated on Drawings.

1. MATCH EXISTING BRICK.

B. Section Includes:

1. Concrete masonry units.
2. Prefaced concrete masonry units, ground and split face.
3. Lintels.
4. Brick.
5. Mortar and grout materials.
6. Joint Reinforcement Ties and Anchors
7. Embedded flashing.
8. Accessories.
9. Mortar and grout mixes.

C. Related materials:

1. Flashing.
2. Cavity insulation; Extruded Polystyrene Board Insulation.
3. Brick vents.

D. Requirements of this section apply to masonry work specified in Division -4 section "Reinforced Unit Masonry".

1.3 REFERENCES

A. Codes and Standards:

1. Brick Institute of America

    a. Technical Notes on brick construction.

2. National Concrete Masonry Association (NCMA)

a. "Specifications for the Design and Construction of Load Bearing Concrete Masonry", latest edition.

3. American Concrete Institute (ACI)

a. ACI 530.1 “Specifications for Masonry Structures.”
b. ACI 531 "Building Code Requirements for Concrete Masonry Structures".

4. American Society for Testing and Material (ASTM).
5. Underwriters Laboratories, Inc. (UL).

B. Products furnished, but not installed, under this Section include the following:

1. Dovetail slots for masonry anchors, installed under Division 3 Section "Cast-in-Place Concrete."
2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."

C. Products installed, but not furnished, under this Section include the following:

1. Steel lintels, and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."
2. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."
3. Hollow-metal frames in unit masonry openings, furnished under Division 8, Section "Steel Doors and Frames."

1.4 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Record discussions and agreements and furnish copy to each participant.

1.6 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

1. Submit complete product data, including engineering calculations, for each condition where pre-cast concrete lintels are to be used.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples:

1. Initial Selection:

a. Unit masonry (small scale): Full extent of colors, textures available each type.
b. Colored masonry mortar: Full extent of colors available.

2. Verification:

a. Each type exposed masonry; full range of exposed color, texture for completed work.

1) Size variation data verifying actual brick size range within ASTM C 216 dimension tolerances where modular dimensioning indicated.

b. Through-Wall Flashing.

1) Full size sample – 12” long.

c. Weep holes/Vents.
d. Colored Masonry Mortar Samples: Each color, full range for finished work.

1) Label samples with type, amount of colorant.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.

a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Mortar complying with property requirements of ASTM C 270 & BIA M1.
3. Grout mixes complying with compressive strength requirements of ASTM C 476 Include description of type and proportions of grout ingredients.

1.7 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of the following:

1. Masonry units.

a. Include data on material properties.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.

c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
d. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

B. Qualification Statements: For testing agency.

C. Delegated design engineer qualifications.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. General: Where codes, standards or regulations referenced in this section, compliance with such codes, standards or regulations shall be considered the minimum applicable standards. Where requirements of this sections exceed the requirements of the referenced standard the requirements of this section shall govern.

1. Where reference is made to ASTM standards, such reference shall exclude reference to provisions related finish of concrete masonry units.

B. Codes and Standards: Comply with provisions of following, except as otherwise indicated herein:

1. National Concrete Masonry Association (NCMA): 'Specifications for Design and Construction of Load Bearing Concrete Masonry' latest edition.
2. American Concrete Institute (ACI): ACI 530.1 'Specifications for Masonry Structures' and ACI 531, 'Building Code Requirements for Masonry Structures'.

C. Fire Performance Characteristics: ASTM E 119 test by laboratory acceptable to authorities having jurisdiction.

1. CMU manufacturer’s U.L. (Underwriters Laboratory) certification showing authority to make U.L. rated masonry.

2. Certification by Georgia licensed professional engineer (P.E.) that concrete masonry for fire walls meets UL618, Class D-2, C-3 and B-4.

D. Single Source Responsibility:

1. CMU: One manufacturer each different exposed product.
2. Mortar: One manufacturer each cementitious component.
3. Aggregate: One source, producer.

E. Field Constructed Mock Ups: Prior to installation of masonry work, erect sample wall panels to further verify selection made for color and textural characteristics, under sample submittals of masonry units and mortar, and to represent completed masonry work for qualities of appearance, materials and construction; build mock-ups to comply with following requirements:

1. Locate mock-ups on site in locations indicated or, if not indicated, as directed by Architect.
2. Construct number of mock-up panels necessary to obtain an acceptable mock up in color and quality. The contractor shall assume that four mock panels will be required.
3. Build mockups for the following types of masonry in sizes of approximately 6' long by 4' high by full thickness, including face and back-up wythes as well as accessories.

    a. Separate mock-up for each specified brick, typical exterior brick wall, each backed by one or more types of concrete masonry units specified so that each is represented, using specified mortar(s), damproofing, insulation and joint reinforcing.
    b. Typical interior partition of concrete masonry units.
    c. Provide examples of the following joint types:

        1) "V" joint at brick.
        2) "V" and concave joint at standard concrete masonry.
        3) Concave joint at split face concrete masonry.

4. Where masonry is to match existing, erect panels parallel to existing surface.
5. Erect mock-ups in presence of Architect.
6. Protect mock-ups from the elements with weather resistant membrane.
7. Retain mock-ups during construction as standard for judging completed masonry work.
8. When directed, demolish mock-ups and remove from site.
9. Approved mock-ups shall be utilized to establish the acceptable standard of quality to be utilized throughout the project.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver in undamaged condition.

1. Face brick shall be delivered on pallets or placed on pallets at time of unloading. Do not store brick in contact with earth.

B. Store, handle to prevent deterioration, damage due to moisture, temperature changes, contaminants, corrosion, other causes.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates to maintain grading, other required characteristics.

E. Store masonry accessories to prevent corrosive deterioration, accumulation of dirt.

F. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.10 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

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

1. Do not lay wet or frozen masonry units.

2. Remove ice, snow formed on masonry bed; carefully apply heat until top surface dry to touch.
3. Remove freeze-damaged masonry.
4. Do not lay masonry when:

    a. Air temperature below 40ºF (falling thermometer).
    b. If probable temperatures below 40ºF encountered before mortar set, unless providing adequate means of protection.

5. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Masonry to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

B. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 602.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, use the equivalent thickness method for masonry units in accordance with ACI 216.1.

2.3 LINTELS

A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.

B. Concrete Lintels: Precast or formed-in-place concrete lintels.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Comply with referenced standards, other requirements indicated, applicable to each type of brick.

1. Provide shapes indicated and as follows:

a. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
b. Provide bullnose units for outside corners, unless otherwise indicated.
c. Provide square-edged units for outside corners, unless indicated as bullnose.

B. Provide samples for mock-ups specified in PART 1, final selection made from mock-ups.

C. Manufacturers: **MATCH EXISTING.**

D. Size: **MATCH EXISTING.**

E. Sills, caps, similar applications exposing brick surfaces otherwise concealed from view; uncored, unfrogged units, exposed surfaces finished.

F. Facing Brick: ASTM C 216:

1. Grade: SW.
2. Type: FBS (normal size and color variations).
3. Compressive Strength: 8,000 psi, average; ASTM C 67.
4. Application: Exposed locations, unless otherwise indicated.

G. Building Common Brick: ASTM C 62:

1. Grade:

a. SW.
b. MW except Grade SW, ASTM C 216 grade for applicable weathering index, exposure.

2. Application: Concealed locations.

2.5 GROUND-FACED CONCRETE MASONRY UNITS

A. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi, 2150 psi, 2800 psi, 3050 psi ASTM C 90 and as follows.

B. Weight Classification: Lightweight, Medium weight, Normal weight, unless otherwise indicated.

C. Manufacturers: Match existing.
   1. York Building Products.

D. Exposed Faces: Provide where indicated on Drawings:

   1. Face Style: Match existing.
   2. Face Texture: Match existing.
   3. Ground face: Match existing.
   4. Color range: Match existing.

E. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.

F. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Block Plus W-10; Addiment Inc.
   2. Dry-Block; W. R. Grace & Co., Construction Products Division.
   3. Rheopel; Master Builders.

G. Exposed faces matching color, texture, pattern Match Existing in color texture in every respect.

H. Special shapes: Where required for lintels, corners, jambs, sash, control joints, headers, bonding, other special conditions.

   1. Match size with decorative units; motor joints must align and be consistent width.
   2. Square-edged units: unless otherwise indicated.

2.6 CONCRETE MASONRY UNITS

A. Comply with referenced standards, other requirements indicated, applicable to each type concrete masonry units (CMU).

B. Concrete Masonry Units (CMU): ASTM C 90 and as follows:

   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
   2. Grade:

      a. N except Grade S above grade in exterior walls with weather-protective coatings, walls not exposed to weather.

3. Size: Nominal face 16" L x 8" H (15-5/8" x 7-5/8" actual) x thicknesses indicated.
4. Hollow Loadbearing Block: ASTM C 90:

    a. Weight Classification: Light weight.

5. Solid Loadbearing Block: ASTM C 145:

    a. Weight Classification: Light weight.

6. Concrete Building Brick: ASTM C 55.

    a. Grade: Same as CMU.
    b. Type: Same as CMU.

7. Exposed Faces: Manufacturer's standard color, texture, unless otherwise indicated.
8. Special shapes: Where required for lintels, corners, jambs, sash, control joints, headers, bonding, other special conditions.

    a. Square-edged units:
    b. Outside corners, except specific areas, bullnose outside corners, pilasters:

        1) Foyers
        2) Lobbies.
        3) Corridors
        4) Elsewhere indicated (BN)

2.1 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Masonry Cement: ASTM C91/C91M.

1. Colored pigmented mortars: Premixed colored masonry cements to produce color indicated; if not indicated, selected from manufacturer's standard formulations
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bronco High Strength Masonry Cement; Florida Mining and Material.
    b. Atlas Custom Color Masonry Cement; Lehigh Portland Cement Co.
    c. Flamingo Color Masonry Cement; The Riverton Corp.
    d. Super Hi-Strength Masonry Cement; Lonestar Florida Pennsuco, Inc.

3. Colored aggregate mortars: Natural color or white masonry cement required to produce mortar color indicated.

C. Hydrated Lime: ASTM C207, Type S.

D. Aggregates for Mortar: ASTM C 144; except joints max. ¼", aggregate graded with 100% passing No. 16 sieve.

1. White Mortar Aggregates: Natural white sand or ground white stone
2. Colored Mortar Aggregates: Ground marble, granite, other sound stone, required to match Architect's sample

E. Aggregate for Grout: ASTM C 404, Size No. 2.

F. Colored Mortar Pigments:

1. Natural and synthetic iron oxides, chromium oxides, compounded for mortar mixes.
2. Use only pigments with record of satisfactory performance in masonry mortars.
3. Color Range:

   a. Brick Masonry: Argos - Ivory Buff.
   b. Natural (gray) Masonry: No pigment required.

4. Products: provide one of the following:

   a. La Farge.
   b. SGS Mortar Colors; Solomon Grind-Chem Service, Inc.
   c. True Tone Mortar Colors; Davis Colors, Subsidiary of Rockwood Industries, Inc.

G. Water: Clean, potable.

2.2 JOINT REINFORCEMENT TIES AND ANCHORS

A. Materials:

1. Hot-Dip Galvanized Steel Wire: ASTM A 82 (uncoated wire), ASTM A 153, Class B-2 (1.5 oz./s.f. wire surface) coating applied after prefabrication.

   a. Application: Exterior walls.

2. Austenitic Stainless Steel Wire: ASTM A 580, AISI Type 304 (UNS S30400) alloy.

   a. Application: Exterior walls, Interior walls.

3. Hot-Dip Galvanized Carbon Steel Sheet: ASTM A 366, Class 2 or ASTM A 635; hot dip galvanized after fabrication, ASTM A 153; Class B.

   a. Application: Anchors.

B. Joint Reinforcement: Welded-wire units, deformed continuous side rods, plain cross rods, min. 10' straight lengths, prefabricated corner, tee units:

1. Width: Approximately 2" less than nominal width of walls, partitions, min. 5/8” mortar coverage on joint faces exposed to exterior, 1/2" elsewhere.
2. Wire Size, Side Rods:

   a. 9 ga. (0.1483") diameter.

3. Wire Size, Cross Rods:

a. 9 ga. (0.1483") diameter.

4. Single-wythe masonry, single pair of side rods:

a. Truss design: Diagonal cross rods max. 16" o.c.

1) AA Wire Products Co.; AA600, Blok-Truss.
2) Dur-O-Wall, Inc.; Truss, Single Wythe.
3) Hohmann & Barnard, Inc.; #120, Truss-Mesh.
4) Masonry Reinforcing Corporation of America; Series 300, 2 wire single wythe truss type.
5) National Wire Products Industries; single wythe truss type.
6) Southern Construction Products, Inc.; single wythe truss type.

5. Multi-wythe masonry:

a. Ladder design: Perpendicular cross rods max. 16" o.c.

1) Brick, CMU Backup (no cavity): One side rod each face shell of CMU backup, one rod for brick wythe.

a) Dur-O-Wall, Inc.; Ladur Trirod.
b) Hohmann & Barnard, Inc.; #230, Ladder-Tri-Mesh.
c) Masonry Reinforcing Corporation of America; Series 200, 3-wire composite ladder type.
d) Southern Construction Products, Inc.; ladder 3-wire style.

2) Two Wythe CMU: One side rod each face shell of CMU back-up and CMU facing wythe.

a) Dur-O-Wall, Inc.; Ladur – Double.
b) Hohmann & Barnard, Inc.;#240 "Ladder-Twin-Mesh.
c) Masonry Reinforcing Corporation of America; Series 200, 4-wire composite ladder type.
d) Southern Construction Products, Inc.; ladder 4-wire style.

3) Two Wythe Brick: Ladder design, perpendicular cross rods max. 16" o.c.

a) Dur-O-Wall, Inc.; Ladur, Single Wythe.
b) Hohmann & Barnard, Inc.; #220 Ladder-Mesh.
c) Masonry Reinforcing Corporation of America; Series 200, 2 wire single wythe ladder type.
d) Southern Construction Products, Inc.; single wythe ladder type.

b. Truss design: Diagonal cross rods max. 16" o.c.

1) Brick, CMU Backup (insulated cavity and uninsulated): One side rod each face shell of CMU backup, adjustable pintel/eye type or winged loop/box type tie 16" o.c. into brick wythe.

a) Dur-O-Wall, Inc.; Dur-O-Eye.

b) Hohmann & Barnard, Inc.; #170 "Adjustable Eye-Wire" or #AF-Ajustoflex Truss.
c) Masonry Reinforcing Corporation of America; Series 900, cavity hook/eye.
d) Southern Construction Products, Inc.; "double-eye" truss, rectangular type.

C. Flexible Anchors: Connect masonry to structural frame, 2-piece anchors for vertical or horizontal differential movement between wall and framework parallel to (resist tension, compression forces perpendicular to) plane/wall.

1. Concrete anchorage: Manufacturer's standard anchors, dovetail anchor section, 0.1046" (12 ga.) sheet metal, triangular-shaped wire tie section, extend within 1" of face.

a. Wire Size: 0.1875" dia.
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dur-O-Wall, Inc.; D/A 100 + D/A 720 or D/A 723 as applicable.
2) Hohmann & Barnard, Inc.; 305 + 315.
3) Masonry Reinforcing Corporation of America; 2102.
4) Southern Construction Products, Inc.; 10802 + Series 700.

2. Steel anchorage: Manufacturer's standard anchors, welded anchor section, 0.1046" (12 ga.) sheet metal, triangular-shaped wire tie section, extend within 1" of masonry face.

a. Wire Size: 0.1875" dia.
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dur-O-Wall, Inc.; D/A 207 + D/A 702.
2) Hohmann & Barnard, Inc.; 359F + #VWT.
3) Masonry Reinforcing Corporation of America; 1000 + 1100.
4) Southern Construction Products, Inc.; 703 + Series 700.

c. Refer to structural drawings for rigid masonry ties at some structural steel members.

D. Masonry Veneer Anchors: Two-piece assemblies, vertical/horizontal differential movement between wall and framework parallel to (resist tension/compression forces perpendicular to) plane of wall; wire tie section, metal anchor section, attachment over sheathing to studs:

1. Wire Size: 0.1875" dia.
2. Wire Tie Length: Extend within 1" of masonry face.
3. Wire Tie Length: As indicated.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Triangular Ties:

1) Dur-O-Wall, Inc.; D/A 702 tie + D/A 213 anchor.
2) Hohmann & Barnard, Inc.; V-tie + DW-10 anchor.

3) Masonry Reinforcing Corporation of America; 1100 tie + 1001 anchor.
4) Southern Construction Products, Inc.; Series 700 tie + 710 anchor.

5. Metal Fasteners, Steel Studs:

a. Steel drill screws, #10 dia. x length penetrating stud flange min. 3 exposed threads.
b. ASTM C 954 except hex washer head, neoprene washer, cadmium-plated.

E. Unit Type Masonry Inserts, Concrete: Cast iron or malleable iron inserts; type, size indicated.

F. Anchor Bolts:

1. Steel bolts, hex nuts, flat washers.
2. ASTM A 307, Grade A.
3. Hot-dip galvanized, ASTM C 153, Class C.
4. Sizes, configurations indicated.

2.3 CONCEALEAD LINTEL SYSTEM

A. Concealed lintel system and accessories at locations shown.

1. Lintels shall be engineered and provided by a manufacture with a min. of five years experience providing concealed lintel systems.

B. Materials.

1. Concealed lintel system shall comprise fabricates spines and accessories or brackets bolted to Halfen anchor channels cast into concrete back-up elements. Fastening to be Tee-bolts manufactured specifically for use with anchor bolts.
2. Lintel system components shall be fabricated from steel to ASTM A36 then hot dip galvanized to ASTM A123 or A153 as applicable.
3. Lintel system components shall be fabricated from stainless steel to ASTM A666, type 304, annealed.

C. Anchor channels shall consist of either cold formed or hot rolled channel profiles, with rolled “I” anchors securely attached to the back of the channel with fillet welds.

1. Anchor channels shall be hot dipped galvanized finish, and have a foam filler to prevent concrete seepage.
2. Fasteners used with anchor channels shall have Tee heads to engage in the channel and shall be sized to suit load requirements. Other fastening devices specifically approved by the manufacturer may also be used.

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Halfen.

2.4 CONCEALED, EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual".

B. Sheet Metal Flashing: Use at locations shown and as required for receiver flashing.

1. Stainless Steel: 0.015" thick.
2. Copper: 10 oz. If fully concealed flashing, 16 oz. elsewhere.
3. Through-wall metal flashings: Deformation in both directions (integral mechanical mortar bond).
4. Metal expansion joint strips: Sheet metal indicated above, shape indicated.

C. Flexible Sheet Flashing, Rubberized Asphalt or Polymeric: all though wall flashing

1. Self-sealing, self-healing, gully adhering, composite flexible flashing.
2. Bonded integrally and completely to high density four ply cross-laminated polyethylene film.
3. Protected by silicone coated release sheet removed immediately before installation.
4. Remain flexible, waterproof in concealed masonry.
5. Color: Black.
6. Thickness: Min. 40 mils total.

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Rubberized Asphalt or Polymeric Sheet Flashing

a. Perm-A-Barrier, Grace Masonry Products.
b. W. R. Meadows Flashing system.
c. MiraDRI 860/861, TC MiraDRI.
d. Hyload.
e. Aqua-Flash.

E. Termination Bar:

1. Termination bar for use at top of though wall flashing to hold flashing tight to wall.

a. Type: 304 stainless steel.
b. 1/4 inch holes spaced at 16 inches on center.
c. Size: 1/8 inch by one inch.
d. Screws: Stainless steel.

F. Adhesive for Flashings: Type recommended by flashing material manufacturer for use indicated.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

A. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60.

B. Non-Metallic Expansion Joint Strips: Premolded, flexible cellular neoprene rubber filler strips.

1. ASTM D 1056, Grade RE41E1.
2. Min. 35% compression.
3. Width, thickness indicated.

C. Premolded Control Joint Strips:

1. Fit standard sash block.
2. Maintain lateral stability in masonry wall.
3. Size, configuration indicated.
4. Styrene-butadiene rubber compound, ASTM D 2000, Designation 2AA-805.
5. Polyvinyl chloride, ASTM D 2287, General Purpose Grade, Designation PVC-63506.

D. Bond Breaker Strips:

1. Asphalt-saturated organic roofing felt.
2. ASTM D 226, Type I (No. 15 asphalt felt).

E. Weep Holes:

1. Cotton Cord:

a. Min. 3/8” dia. sash cord.
b. Length for 2" exposure above finish grades on exterior masonry face.
c. Extend 18" vertically in cavity.
d. Keep weep holes, cavity area free of mortar droppings, debris.

F. Cavity Drainage:

1. Cavity drainage system manufactured with high density polyethylene or 100% recycled.

a. Cut in dovetail fashion or folded to provide a 6 inch step. Size to fit thickness of cavity.
b. 90% open weave.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Mortar net.
b. Cav Clear.
c. Holman & Barnard.

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amofoam-CM; Amoco Foam Products Co.
b. Styrofoam SM/SB; Dow Chemical USA.

c. Foamular 250; UC Industries.
d. Certifoam, Minnesota Diversified Products, Inc.

2. R-value: (5-year aged) 5 Btu/(hr x sf x ºF) at 75ºF (24ºC).
3. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
4. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
5. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
6. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
7. Adhesive: Type recommended by insulation manufacturer for application.

2.2 MASONRY SEALERS

A. Masonry Sealers: Manufacturer's standard strength general purpose of sealing for new masonry surfaces of type indicated

1. Clear Solvent based silicone elastomer.
2. Expressly approved for intended use by masonry unit manufacturer.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. "Sure Kleen" Weather Seal Blok Guard & Graffiti Control 15.

2.3 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

B. Mixing:

1. Combine, thoroughly mechanically batch mix cementitious material, water, aggregate.

a. Mixing time, water content: Reference ASTM standards.
b. Accurately measure all ingredients with appropriate measuring devices.
c. Assure proper proportions.
d. Achieve uniform color, texture, quality.

2. Measuring by "shovel" not acceptable.

C. Mortar: ASTM C 270, Proportion Specifications, unless otherwise indicated.

1. Limit cementitious materials in mortar to Portland cement-lime.
2. Type:

a. “M”: Masonry below grade, in contact with earth; where indicated.
b. “S”: Reinforced masonry; where indicated.
c. “N”: Exterior, above grade loadbearing, non-loadbearing walls, interior loadbearing walls, all applications where another type not indicated.

D. Colored Pigmented Mortar:

1. Select, proportion pigments with other ingredients, produce color required.
2. Do not exceed 1-to-10 (by weight) pigment-to-cement ratio.

E. Colored Aggregate Mortar: Colored aggregates, combine with selected cementitious materials.

1. Mix to match Architect's sample.

F. Grout for Unit Masonry: Ready-mixed grout of strength, consistency indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

A. Wetting:

1. Wet clay, shale brick if ASTM C 67 initial rate of absorption (suction) exceeds 30 gr./30 sq. in./min.

a. Ensure each unit nearly saturated but surface dry when laid.

2. Do not wet CMU.

B. Cleaning: Remove rust, scale, earth, other coatings from reinforcing before placing

1. Face brick shall be installed using BIA TEC Notes #20 No masonry cleaner shall be used.

C. Thickness:

1. Cavity, composite walls, floor, other masonry construction: Full thickness shown.
2. Single-wythe walls: Actual masonry unit thickness with nominal thicknesses indicated.
3. Chases, recesses: As shown or required for work of other trades.

D. Leave openings for equipment installed before completion of masonry.

1. After installation of equipment, complete masonry to match work adjacent to opening.

E. Cut units using motor-driven saws; clean, sharp, unchipped edges.

1. Cut for continuous pattern, fitting adjoining work.
2. Where possible, use full-size units without cutting.
3. Cut CMU with dry cutting saws.

F. Matching Existing Masonry Work: Match new coursing, bonding, color, texture with existing.

3.3 CONSTRUCTION TOLERANCES

A. Variation, Plumb:

1. Vertical lines, surfaces of columns, walls, arises: Max. ±1/8” in any story height; 12' max.
2. Vertical alignment, head joints: Max. ±1/4" in any story height; 12' max.

B. Variation, Level:

1. Bed joints, lines of exposed lintels, sills, parapets, other conspicuous lines: Max. ±1/8” in any bay; 20' max.
2. Top surface, bearing walls: Max. ±1/8” in 10' max; 1/16" within length, width of any single unit.

C. Variation, Linear Building Line (position shown in plan, related portion of columns, walls, partitions): Max. 1/8” in any bay; 20' max.

D. Variation, Cross-Sectional Dimension (columns and walls): Max. ±1/4".

E. Variation, Joint Thickness:

1. Unless otherwise indicated, bed, head joints 3/8”.
2. 3/8”, ±1/16"; max. thickness 1/2".
3. Approved field mock up to establish acceptable masonry appearance.

3.4 LAYING MASONRY WALLS

A. Layout walls in advance to accurate space surface bond patterns, uniform joint widths.

1. Accurately locate openings, movement-type joints, returns, offsets.
2. Use no less-than-half-size units at corners, jambs, other locations.

B. Lay walls to specified tolerances.

1. Accurately space courses.
2. Coordinate with other work.

C. Pattern Bond:

1. Exposed masonry: Bond pattern shown.

    a. If not shown, running bond, each vertical joint centered on units in courses above, below.

2. Exposed masonry:

    a. Brick: Running bond except as otherwise indicated.
    b. CMU: Stacked bond except as otherwise indicated.

        1) Split-faced CMU: Running bond.
        2) 2-, 3-, or 4-hour Fire-rated CMU: Running bond.

3. Concealed masonry: Running bond or bond by lapping min. 2".
4. Bond, interlock each course, each wythe at corners.
5. Corners, jambs: Min. nominal 4" horizontal face dimension.

D. Fire Rated Walls:

1. 2-hour: UL Design U 905.
2. 3-hour: UL Design U 904.
3. 4-hour: UL Design U 901.

E. Stopping and Resuming Work:

1. Rack back 1/2-unit length each course; do not tooth.
2. Clean exposed surfaces of set masonry.

    a. Wet units lightly (if required).
    b. Remove loose masonry units, mortar prior to laying fresh mortar.

F. Built-in Work:

1. As work progresses, build-in items specified herein and other sections.
2. Fill around built-in items solidly with masonry.
3. Space between metal frames and masonry: Solid mortar unless otherwise indicated.
4. Exterior frames: Thermal break.

    a. Extruded polystyrene board insulation at perimeter.
    b. Thickness indicated, min. 3/4".

5. Built-in items embedded in cores of hollow masonry:

    a. Layer metal lath in joint below.
    b. Rod mortar, grout into core.

6. Cores in hollow masonry units under bearing plates, beams, lintels, post, similar items:

    a. Grout min. 3 courses (24") under item, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Solid brick-size masonry units:

1. Completely fill bed and head joint.
2. Butter ends fully with mortar to fill head joints, shove into place.
3. Do not slush head joints.

B. Hollow CMU: Full mortar coverage on horizontal, vertical face shells.

1. Bed webs in mortar in starting course on footings, all courses of piers, columns, pilasters, where adjacent to cells reinforced or filled with concrete or grout.
2. Starting course on footings where cells not grouted: Spread full mortar bed including areas under cells.
3. Max. setting bed on foundations of 3/4".

    a. If foundation uneven, low in excess of 3/4", cut masonry to height for filler course.

C. Maintain joint widths shown, except minor variations to maintain bond alignment.

1. 3/8” joints unless otherwise indicated.

D. Exposed joints:

1. Tool when mortar thumb-print hard with jointer slightly larger than joint thickness.
2. Produce smooth, dense finish, straight lines of uniform depth, appearance throughout project:
3. Brick Joints: Selected by Architect, "V" or raked joint.
4. CMU Joints:

    a. Generally: Selected by Architect, "V" joint or concave joint.
    b. Kitchen and Toilets: Concave joint.

5. Masonry concealed, covered by other materials: Flush joints unless otherwise indicated.
6. Immediately after tooled:

    a. Brush (soft bristled) across joint (90º to joint) and masonry.
    b. Clean of excess mortar, sand.

E. Remove masonry, if disturbed after laying, remove masonry:

1. Clean, reset in fresh mortar.
2. Do not pound corners or jambs to shift adjacent stretcher units set in position.
3. If adjustments required, remove units, clean off mortar, reset in fresh mortar.

3.6 CONCRETE TIE BEAMS

A. Horizontal reinforced concrete beams, bond beams: Special units or modified regular units for placement of continuous horizontal bars.

1. Small mesh expanded metal lath, wire screening in mortar joints under beam courses over vertical non-reinforced cores or cells, or units with solid bottoms.
2. Do not use sheet metal, felt, or building paper.
3. Maximum spacing, 8’.

3.7 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

A. Provide at top termination of all walls.

B. Systems:

1. Continuous horizontal joint reinforcement in horizontal joints:

a. Max. 16" o.c. vertically.

C. Corners: Interlocking masonry unit bond each course at corners, unless otherwise shown.

D. Horizontally reinforced masonry, corners: Prefabricated "L" units, in addition to masonry bonding.

E. Intersecting, Abutting Walls: Unless vertical expansion or control joints juncture, same type bonding as between wythes:

1. Individual metal ties: Max. 16" o.c. vertically.
2. Prefabricated "T" units.

F. Intersecting Load-bearing Walls:

1. If carried up separately, block and tooth vertical joint with 8" max. offsets.

a. Rigid steel anchors max. 4'-0" o.c. vertically.
b. Omit blocking, rigid steel anchors max. 2'-0" o.c. vertically.
c. Either of above.

2. Anchors: Galv. steel, min. 1-1/2" x 1/4" x 2'-0" long.

a. Turn up ends min. 2" or use cross-pins.
b. Embed ends in mortar-filled cores of hollow masonry units.

G. Non-bearing Interior Partitions:

1. 12" to 18” above ceiling unless otherwise shown.
2. Full height to underside of solid floor or roof structure where no ceiling exists, unless otherwise shown.
3. Top cover shall be bond beam with 2 #5 bars.

3.8 HORIZONTAL JOINT REINFORCEMENT

A. General:

1. Continuous horizontal joint reinforcement indicated
2. Longitudinal side rods in mortar entire length, min. 5/8” cover exterior side of walls, 1/2" elsewhere.
3. Lap reinforcing min. 6".

B. Cut, interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted omitted.

D. Reinforce walls with continuous horizontal joint reinforcement:

1. Single wythe walls.
2. Multi-wythe walls, one or more stack bond wythes.
3. Hollow concrete masonry walls.
4. Multi-wythe masonry walls.
5. Corners, wall intersections: Prefabricated "L" and "T" sections.

    a. Cut, bend reinforcement by manufacturer’s instructions at returns, offsets, column fireproofing, pipe enclosures, other special conditions.
    b. Spacing:

        1) Multi-wythe walls (solid or cavity): Where continuous horizontal reinforcement is tie between wythes, space by code requirement, max. 16" o.c. vertically.
        2) Single-wythe walls: 16" o.c. vertically, unless otherwise indicated.
        3) Parapets: 8" o.c. vertically, unless otherwise indicated.

6. Masonry openings (over 1'-0" wide): Reinforce 2 horizontal joints approximately 8" apart.

    a. Immediately above lintel.
    b. Immediately below sill.
    c. Min. 2'-0" beyond opening jambs except at control joints.
    d. Comply with above in addition to wall reinforcement.

3.9 ANCHORING MASONRY WORK

A. General: Devices of type indicated.

B. Anchor to structural members where masonry abuts or faces structural members:

1. Min. 1" wide open space between masonry and structural member, unless otherwise indicated.
2. Keep open space free of mortar, other rigid materials.
3. Embed flexible anchors in masonry joints, attach to structure.

    a. Space as indicated, max. 16" o.c. vert., 16" o.c. horiz.

C. Anchor veneer to studs with masonry veneer anchors:

1. Two (2) fasteners each, through sheathing to studs.
2. Embed tie section in masonry joints.

3. Min. 1" air space between masonry and sheathing.
4. Locate anchor at course in which tie section embedded.
5. Allow max. vertical differential movement up and down.
6. Space as indicated, max. 16" o.c. vert., 16" o.c. horiz.

    a. Additional anchors within 1'-0" of openings, max. 3'-0" around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

A. General:

1. Vertical, horizontal expansion; control, isolation joints, where shown.
2. Vertical control joints (all CMU walls): Max. 30'-0".
3. Build-in related items as work progresses.

B. Extend flanges of metal expansion strips into masonry.

1. Lap joints 4" in water flow direction.
2. Seal joints below grade, at junctures with horizontal expansion joints, if any.

C. Extend factory-fabricated expansion joint flanges into masonry.

D. Non-metallic joint filler where indicated.

E. Horizontal pressure relieving joints where indicated; leave air space or insert non-metallic compressible joint filler of width required for installation of sealant, backer rod.

F. Attach horizontal pressure relieving joints beneath shelf angles supporting masonry veneer to structure behind masonry veneer.

3.11 LINTELS

A. Steel lintels where indicated.

B. Masonry lintels shown or openings over 1'-0" for brick units, 2'-0" for CMU, without structural steel, other supporting lintels.

1. Precast or formed-in-place masonry.
2. Cure precast lintels before handling and installation.
3. Temporarily support formed-in-place lintels.
4. Hollow CMU walls: U-shaped lintel units, reinforcement bars shown, fill with coarse grout.
5. Min. 8" bearing at each jamb, unless otherwise indicated.

3.12 CONCEALED LINTEL SYSTEM

A. Installation

1. Concealed lintel system shall be installed as indicated in the approved shop drawings.

2. Anchor channels shall be securely fastened to concrete work in accordance with manufacturer's instructions.
3. Attachment to the anchor channel shall be by Tee-Bolts manufactured specifically for use with the anchor channel or other attachment device approved by manufacturer. Only fastening devices manufactured or approved by the manufacturer of the anchor channel shall be used.

3.13 CAVITY INSULATION INSTALLATION

A. Space small pads of adhesive approximately 1'-0" o.c. each way on inside face of plastic insulation.

1. Fit units between wall ties, other confining obstructions in cavity, butt edges tightly both ways.
2. Press units firmly against inside wythe of masonry, other construction shown.
3. Open gaps, cracks in insulation: Crack sealer compatible with insulation, masonry.

3.14 FLASHING INSTALLATION

A. General:

1. Conceal flashing at and above, shelf angles, lintels, ledges, other obstructions in wall.
2. Divert water to exterior.
3. Apply to smooth surfaces, free from projections puncturing flashing.
4. Set through-wall flashing on solid clean masonry or lintel, extend up wall minimum 8 inches. Cover with mortar. At CMU walls through to interior wythe to within ½" of interior face.
5. At metal framing provide continuous termination bar and fasten at 16 inch on center. Seal top edge with mastic and shingle air infiltration barrier over.
6. Seal flashing penetrations with mastic before covering with mortar.
7. Extend flashings through exterior face of masonry, turn down to form drip.

B. Flash full length of lintels, shelf angles, min. of 4" into masonry each end.

1. Flash from within 1/2" of interior wall face to outer face of interior wythe, down min. 4", then across shelf flashing to within 1-1/4" of outside edge of lintel.

    a. Self-adhering flexible flashing may be installed in two operations, lapping outer wythe flashing min. 2" over inner wythe flashing on vertical face.

2. Where interior of inner wythe concealed by furring, extend through inner wythe, turn up 2".
3. Heads and sills: Turn ends up min. one course, forming pan.
4. Deformed metal flashing:

    a. Interlock end joints.
    b. Over-lap deformations min. 1-1/2".
    c. Seal lap with elastic sealant.

C. Comply with manufacturer's installation instructions for flashing.

D. Weep Holes:

1. Head joints in first course immediately above concealed flashings.
2. 24" o.c., unless otherwise indicated.

E. Build reglets, nailers for flashing, other related work into masonry work.

3.15 MASONRY SEALER INSTALLATION

A. Apply Masonry sealer.

1. At all fenestration openings at jamb head and sill.
2. Control joint expansion joint locations.
3. Louvers vents and other locations receiving sealant.
4. At each entrances to building confirm extent of application with architect on site.
5. Clean area using a stiff clean natural hair bristle brush.
6. Apply sealer using a brush or spryer apply at areas to receive sealant including sealant cavity area.

3.16 REPAIR, POINTING, AND CLEANING

A. Remove, replace loose, chipped, broken, stained, otherwise damaged units, or if units do not match adjoining.

1. Match new to adjoining units.
2. Install in fresh mortar or grout.
3. Point to eliminate evidence of replacement.

B. Pointing:

1. During tooling of joints, enlarge voids or holes, except weep holes, completely fill with mortar.
2. Point-up all joints (corners, openings and adjacent work).

    a. Neat, uniform appearance.
    b. Prepare for application of sealants.

C. Final Cleaning CMU: After mortar thoroughly set and cured, clean masonry:

1. Remove large mortar particles with wooden paddles, nonmetallic scrape hoes, chisels.
2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison.
3. Obtain Architect's approval of sample cleaning before proceeding.

D. Brick masonry: BIA "Technical Note No. 20 Revised", use NO masonry cleaner:

1. Protect site-stored brick from mud. Store brick off the ground under protective covering.

2. Cover wall openings and tops of walls with a waterproof membrane at the end of workday and at other work stoppages to prevent mortar joint wash out and entry of water into the completed masonry.
3. Protect newly constructed brickwork from adjacent construction practices that may cause staining, such as placing concrete of spraying curing agent. It is always advisable for masons to keep brickwork as free from mortar smears as possible. Masons should also be careful to prevent excessive mortar droppings from contacting the face of the wall of falling into the air space. In addition to the bricklaying techniques described in Technical Note 7B, the practices below should be followed:

    a. After spreading mortar, but before laying brick, the trowel edge should be used to cut mortar even with the wall face, preventing excessive extrusion of mortar onto the face of the wall as the bricks are laid.
    b. After tooling joints, excess mortar and dust should be brushed from the surface, preferably using a medium- soft bristle or fiber brush. Brushes with steel bristles are not recommended as they may leave behind small particles with can rust. Brushing is preferable to bagging of sacking. Avoid any motion that will result in rubbing or pressing mortar particles into the brick faces.

E. CMU: Clean by masonry manufacturer’s directions, applicable NCMA "Tek" bulletins

F. Limestone: Clean as recommended in Indiana Limestone Institute of America “ILI Handbook.”

G. Protection: Protect, maintain conditions acceptable to Installer, and ensure work without damage, deterioration at Final Acceptance.

END OF SECTION 04 2000

SECTION 05 1200 - STRUCTURAL STEEL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

A. The extent of structural steel work is shown on the drawings, including schedules, notes and details to show size and location of members, typical connections and type of steel.

B. Approval by the Owner or his representative of shop drawings prepared by the fabricator indicates the fabricator has correctly interpreted the contract requirements. Approval does not relieve the fabricator of the responsibility for accuracy of detailed dimensions on shop drawings nor the general fit-up of parts to be assembled in the field.

1.3 SUMMARY

A. This Section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.

B. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.

C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

D. Refer to Division 3 for anchor rod installation in concrete, Division 4 for anchor rod installation in masonry.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
   1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
   2. High-strength bolts (each type), including nuts and washers.
   3. Unfinished bolts and nuts.
   4. Structural steel primer paint.
   5. Shrinkage-resistant grout.

C. Shop drawings prepared under supervision of a licensed Structural Engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
   1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
   2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
   3. Submit shop drawings including complete details and schedule for fabrication and shop assembly of members, and details, schedules, procedures and diagrams, showing the sequence of erection.
   4. Contractor shall check, approve and stamp all shop drawings prior to submittals to Architect.
   5. The shop drawings shall be reviewed by Architect prior to fabrication. Architect=s review is for design only. Contractor is responsible for dimensions, quantities, and coordination with other trades. Engineer=s review and acceptance of shop drawings is subject to all contract requirements and does not authorize any changes involving additional cost to Owner.
   6. Include details of cuts, connections, splices, camber and holes. Indicate welds by standard AWS symbols, and show size, length and type of each weld.
   7. Provide setting drawings, templates, and directions for the installation of anchor bolts and anchorages to be installed by others.
   8. Shop drawings shall be made to conform to the design drawings. Contract drawings shall take precedence over Shop Drawings.
   9. Shop drawings that include elements designed by the fabricator shall be signed and sealed by a professional engineer licensed in the State of Georgia.

D. Test reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and test results.

E. For each approved fabricator that is exempt from special inspections of shop fabrications and implementation procedures in accordance with Section 1704.2.5.2 of IBC 2012, the Contractor shall submit AFabricator=s Certificate of Compliance@. Contractor shall also provide copies of fabricator=s certification or building code evaluation services report and fabricator=s quality control manual.

1.5 QUALITY ASSURANCE

A. Codes and Standards:
   1. Comply with provisions of following, except as otherwise indicated:
   2. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges."
   3. AISC "Specifications for Structural Steel Buildings," including "Commentary."
   4. AISC "Specification for Structural Joints using High-Strength Bolts@.
   5. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel."
   6. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

B. Fabrication and Erection Qualifications:
   1. Fabricator and erector must have a minimum of five years experience with a proven record of satisfactory work.

2. Fabricator and erector must have had work of similar type of construction to be considered as Asatisfactory work@.
3. Fabricators must meet requirements set forth in Section 1704.2.5 of IBC 2012 except Fabricators who are exempt based on participation in the AISC Quality Certification Program and are designated an AISC-Certified Plant, Category Sbd.
4. The Architect shall be the sole judge as to whether the fabricator and erector satisfactorily meets these requirements.
5. ASteel Fabricator@ and ASteel Erector@ shall be an organized steel company engaged in this type of work.
6. If any fabricator or steel erector is doubtful as to whether he meets these requirements, he may submit information to the Architect at least 10 days before the bid opening in order to qualify.

C. Qualifications for Welding Work:
1. Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within the previous 12 months.
3. If recertification of welders is required, retesting will be Contractor's responsibility and shall be at no cost to the Owner.

D. Source Quality Control:
1. Materials and fabrication procedures are subject to inspection and tests in the mill, shop and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
2. Remove and replace materials or fabricated components which do not comply.

E. Design of Members and Connections:
1. All details are typical; similar details apply to similar conditions, unless otherwise indicated on the drawings. Verify dimensions at the site without causing delay in the work.
2. Notify the Architect whenever design of members and connections for any portion of the structures is not indicated on the drawings or specified herein.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

B. Structural Steel Wide Flange Shapes: ASTM A992 Grade 50.

C. Other Structural Steel Shapes, Plates, and Bars: ASTM A36.

D. Cold-Formed Steel Tubing: ASTM A500, Grade C, Grade 50.

E. Round HSS: ASTM A500, Grade C, Grade 50 KSI.

F. Steel Pipe: ASTM A53, Type E or S, Grade B.
   1. Finish: Black, except where indicated to be galvanized.

G. Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.

H. Anchor Rods: ASTM F1554, headed type, grade 36, unless otherwise indicated.

I. Unfinished Threaded Fasteners:
   1. ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.
   2. Provide either hexagonal or square heads and nuts, except use only hexagonal units for exposed connections.

J. High-Strength Threaded Fasteners:
   1. Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
   2. ASTM F3125 AStandard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 Mpa Minimum Tensile Strength@.
   3. Where indicated as galvanized, provide units that are zinc coated, either mechanically deposited complying with ASTM B 695, Class 50, or hot-dip galvanized complying with ASTM A 153.
   4. Twist-off type tension-control bolt assemblies complying with ASTM F1852.

K. Electrodes for Welding: Comply with AWS Code.

L. Structural Steel Primer Paint: SSPC - Paint 11.

M. Non-metallic Shrinkage-Resistant Grout:
   1. Premixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621.

2.2 FABRICATION

A. Shop Fabrication and Assembly:
   1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide parabolic camber in structural members where indicated.
   2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

B. Connections:
   1. Weld or bolt shop connections, as indicated.
   2. Provide high-strength threaded fasteners for all principal bolted connections, except unfinished bolts may be used for temporary bracing to facilitate erection. Bolts through 4" wide beam flanges shall be 5/8" diameter. Other bolts shall be 3/4" diameter.
   3. Unless indicated or detailed otherwise on plans, all connections shall be detailed and designed by the fabricator under the direct supervision of a Professional Engineer, registered in the State of Georgia. Connections shall be designed as unrestrained flexible connections described as simple connections under Section B3 of the AISC Specifications for Structural Steel Buildings.
   4. Except where otherwise detailed or specified on the contract drawings, all framed connections shall be detailed and designed by the fabricator in accordance with Part 9 of the AISC Manual of Steel Construction. Framed beam connections shall be capable of transmitting a minimum of fifty percent of total capacity of beam determined from the tables in Part 3 of AISC Manual of Steel Construction for shape and span unless otherwise noted on the drawings.
   5. Design calculations for the connections designed by the contractor shall be submitted for the files of the architect. Calculations shall bear the seal of a Professional Engineer registered in the State of Georgia. Shop drawings containing connections for which calculations have not been received will be returned unchecked as incomplete submittals.
   6. Connections shall be detailed and designed with provisions for eccentricities. Minimum connection capacity to be 10 kips unless otherwise noted on the drawings.

C. Bolt field connections, except where welded connections or other connections are indicated.
   1. Provide high-strength threaded fasteners for all bolted connections.
   2. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.
   3. All bolted connections shall be pretensioned.

D. High-Strength Bolted Construction:
   1. Install high-strength threaded fasteners in accordance with AISC "Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 Mpa Minimum Tensile Strength".
   2. All bolts shall have a hardened washer under the turning element.
   3. Installation of direct tension indicator bolt systems shall be in accordance with manufacturer=s instructions.
   4. To the extent possible, all bolted connections shall be made with twist-off type bolts unless field clearances prohibit such bolting.

E. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

F. Assemble and weld built-up sections by methods that will produce true alignment of axes without warp.

2.3 SHOP PAINTING

A. General:
1. Shop-paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.
2. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
3. Do not paint surfaces scheduled to receive sprayed-on fireproofing.
4. Do not paint steel scheduled to be hot-dipped galvanized.
5. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
1. SP-1 "Solvent Cleaning."
2. SP-2 "Hand-Tool Cleaning."
3. SP-3 "Power-Tool Cleaning."
4. SP-6 "Commercial Blast Cleaning."
5. SP-7 "Brush-Off Blast Cleaning."

C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

D. Painting: Provide a two-coat, shop-applied paint system complying with Steel Structures Painting Council (SSPC) Paint System Guide No. 7.00.

2.4 SOURCE QUALITY CONTROL

A. General:
1. Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Testing agency will perform at least one shop inspection at the start of fabrication to verify the fabricators quality assurance and quality control procedures, and qualification for exemption from shop inspections required by IBC 2012 Chapter 17. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
2. Promptly remove and replace materials or fabricated components that do not comply.

B. Design of Members and Connections:
1. Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

2. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

PART 3 EXECUTION

3.1 ERECTION

A. General:
1. Comply with AISC Specifications, AISC Code of Standard Practice, OSHA requirements, and as herein specified.
2. All steel framing shall be considered non-self-supporting steel frames as defined by Article 7.9.3 of the AISC Code of Standard Practice dated September 1, 1986.
3. Contractor shall provide all necessary temporary support until required connections or other interacting elements are complete, including all diaphragms, horizontal bracing, moment frames, braced frames, and shear walls.

B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

D. Setting Base Plates and Bearing Plates:
1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
2. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
3. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
4. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
5. For proprietary grout materials, comply with manufacturer's instructions.

E. Field Assembly:
1. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
2. Level and plumb individual members of structure within specified AISC tolerances.
3. Splice members only where indicated and accepted on shop drawings.

F. Erection Bolts:
1. On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.
2. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

G. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

H. Touch-Up Painting:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
2. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.

3.2 QUALITY CONTROL

A. Engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

B. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Testing agency may inspect structural steel at plant before shipment.

E. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any non-compliance of original work and to show compliance of corrected work.

F. Shop-Bolted Connections:
1. Inspect or test in accordance with AISC specifications.

G. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
   1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   2. Perform visual inspection of all welds.
   3. Perform tests of tension and moment resisting welds using one of the following procedures:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
      c. Radiographic Inspection: ASTM E 94; minimum quality level "2-2T."
      d. Ultrasonic Inspection: ASTM E 164.

H. Field-Bolted Connections:
   1. Inspect in accordance with AISC specifications.

I. Field Welding: Inspect and test during erection of structural steel as follows:
   1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   2. Perform visual inspection of all welds.

END OF SECTION 05 1200

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SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior Conditions:

a. Load Bearing.
b. Suspended ceilings and soffits.
c. Furring framing (framing not extending to floor).
d. Other areas other than interior stud walls.

2. Exterior Conditions:

a. Load Bearing.
b. Non-load bearing wall framing.
c. Ceiling, soffit and furring framing.
d. Ceiling joist framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Delegated-Design Submittal: For cold-formed steel framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional, Georgia Licensed, engineer responsible for their preparation.

C. Shop Drawings: Submit, as part of shop drawing review phase of the project, structural engineer design narrative and structural engineering calculations for light gage metal framing system proposed to be used for exterior framing, interior structural framing and interior suspended, furred framing.

1. Indicated size, gages, and spacing of framing materials to be used.
2. Indicate method (type, size and spacing) of attachment of framing to building structure.

3. Indicate methods by which suspended and furred walls and ceilings are to be supported from the structure.
4. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
5. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
6. Provide a complete elevation of each wall show stud spacing, location of bracing state stud size and gauge. stare size of top tract and bottom track.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Certificate of Compliance: Submit, as part of Shop Drawings, certification from manufacturer of product or materials furnished herein, stating that product(s) and / or material (s) being furnished comply with technical provisions contained herein.

1. Any and all deviations from technical provisions of specifications shall be specifically noted.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AllSteel & Gypsum Products, Inc.
2. CEMCO; California Expanded Metal Products Co.
3. ClarkDietrich.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Manufacturing, Inc.
6. Custom Stud.
7. Marino\WARE.
8. SCAFCO Steel Stud Company.
9. Southeastern Stud & Components, Inc.
10. United Metal Products, Inc.
11. United Steel Deck, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Structural Drawings. In addition to the loads noted on Structural Drawings the following shall apply:

a. At interior furrings and soffits, horizontal components to be designed to support loads indicated plus a 250 pound point load at the outboard edge of the furring.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Load-Bearing & Non-Load-Bearing Wall Framing to receive Metal wall panels: Horizontal deflection of 1/240 of the wall height.
b. Exterior Load-Bearing & Non-Load-Bearing Wall Framing to receive brick veneer: Horizontal deflection of 1/720 of the wall height.

c. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
d. Roof Rafter and soffit Framing: Vertical deflection of 1/240 of the horizontally projected span for live loads.
e. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.
f. Interior Soffit and Furring Framing: Vertical deflection of 1/360 of the span for live loads and 1/360 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or over-stressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 1/2 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of interior or exterior sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E119; testing 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 acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST33H Min.
2. Coating: G60, A60, AZ50, or GF30 min. interior and exterior all locations.

2.4 NON-LOAD-BEARING & LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.051-inch min.
2. Flange Width: 1-5/8 inches min.
3. Section Properties: Provide studs to depth shown on drawings modify the gauge, grade of steel and face width as needed to achieve the requirements of 2.2 Performance Requirements.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428-inch min.
2. Flange Width: 1-1/4 inches.

C. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

    a. Minimum Base-Metal Thickness: 0.0428 inch.
    b. Flange Width: 1 inch plus the design gap for one-story structures.

2. Inner Track: Of web depth indicated, and as follows:

    a. Minimum Base-Metal Thickness: 0.0538 inch.
    b. Flange Width: dimension equal to sum of outer deflection track flange width plus 1 inch.

2.5 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches, minimum.
3. Section Properties: Provide to depth shown on drawings modify the gauge, grade of steel and face width as needed to achieve the requirements of PERFORMANCE REQUIREMENTS above.

2.6 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.

2. Flange Width: 1-5/8 inches, minimum.
3. Section Properties: Provide to depth shown on drawings modify the gauge, grade of steel and face width as needed to achieve the requirements of PERFORMANCE REQUIREMENTS above.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and min. thickness of base (uncoated) metal as follows:

1. Depth: 7/8”.
2. Thickness: 20 ga. (0.0359"), unless otherwise indicated.

C. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.

D. Special Solid Backing Support Plates: Wall Backing plates designed to provide a solid backing support for handrails, wall-mounted shelving and similar equipment. ASTM A653/A653M structural steel, zinc coated of grade and coating as follows:

1. Grade 50 (340), Class 1 or 2.
2. Coating: G-60 steel.
3. Minimum Design Thickness of 0.0346 inch (0.879 mm).
4. Product to be equal to Steel Network, Inc. BackIt Rigid Wall Backing plates.

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. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B ASTM A 780.

B. Cement Grout: Portland cement, ASTM C150/C150M, 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.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 FABRICATION

A. Fabricate cold-formed steel 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 steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M 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 screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 2100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING & NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: 32 inches.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: Maximum of 16 inches on center, unless noted or required otherwise. Where required, for loads and deflections indicated, space studs at 8" on center.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated.

H. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

I. Special Solid Backing Support Plates: Install supplementary framing, solid metal backing/support plates, and bracing at terminations in stud framing to support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, wall mounted millwork, casework, toilet room vanities, dressing room counters, equipment, devices, fixtures, toilet partitions, door stops, plumbing fixtures and at other areas where required to provide support for specified items.

1. Extend backing a minimum of 6" above and 12" beyond each side of each wall mounted item.
2. Solid back blocking required behind all permanent wall mounted fixtures, including but not limited to: overhead cabinets (top & bottom), base cabinets (top), miscellaneous shelving, door stops, plumbing fixtures, toilet accessories (all), mechanical equipment and controls, and electrical equipment and controls.
3. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

J. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

K. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

L. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.6 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

SECTION 05 5000 - METAL FABRICATIONS

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. Rough hardware.
2. Pipe bollards.
3. Downspout boots.
4. Miscellaneous framing and supports for the following:

    a. Applications where framing and supports are not specified in other sections.

5. Miscellaneous steel trim.
6. Grout and anchoring cement.
7. Metal ladders.

1.3 COORDINATION

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

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product data for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop drawings detailing fabrication and erection of each metal fabrication indicated.

1. Include plans, elevations, sections, and details of metal fabrications and their connections.
2. Show anchorage and accessory items.
3. Provide templates for anchors and bolts specified for installation under other Sections.

C. Where installed metal fabrications indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis signed and sealed by qualified professional engineer responsible for their preparation.

D. Samples representative of materials and finished products as may be requested by Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Fabricator Qualifications: Firms experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in Work.

B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.

C. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

D. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements:

1. Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings.
2. Coordinate fabrication schedule with construction progress to avoid delay of Work.

    a. Where field measurements cannot be made without delaying Work, guarantee dimensions and proceed with fabrication of products without field measurements.
    b. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.
    c. Allow for trimming and fitting.

1.8 SEQUENCING AND SCHEDULING

A. Sequence and coordinate installation of wall handrails as follows:

1. Mount handrails only on completed walls.
2. Do not support handrails temporarily by any means not satisfying structural performance requirements.
3. Mount handrails only on gypsum board assemblies reinforced to receive anchors, and where location of concealed anchor plates clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.

1. Straight bolts and other stock rough hardware items specified in Division 6 sections.

B. Fabricate items to sizes, shapes, and dimensions required.

1. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.3 FERROUS METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500, grade indicated below:

a. Grade A, unless otherwise shown or required for design loading.
b. Grade B, unless otherwise shown or required for design loading.

2. Hot-Formed Steel Tubing: ASTM A 501.
3. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

D. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade, as follows:

1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:

a. Grade A, unless otherwise indicated or required by design loading.

2. Hot-Rolled Structural Steel Sheet: ASTM A 570, grade as follows:

a. Grade 30, unless otherwise indicated or required by design loading.

E. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:

1. Cold-Rolled Steel Sheet: ASTM A 366.
2. Hot-Rolled Steel Sheet: ASTM A 569.

F. Galvanized Steel Sheet: Quality as follows:

1. Structural Quality: ASTM A 446; Grade A, unless another grade required for design loading, and G90 coating designation unless otherwise indicated.
2. Commercial Quality: ASTM A 526, G90 coating designation unless otherwise indicated.

G. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

1. Black finish, unless otherwise indicated.
2. Galvanized finish for exterior installations and where indicated.
3. Type F, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.
4. Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another grade or weight or both required by structural loads.
5. Type S, Grade B, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.

H. Gray Iron Castings: ASTM A 48, Class 30.

I. Malleable Iron Castings: ASTM A 47, grade 32510.

J. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

K. Concrete Inserts:

1. Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27.
2. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

L. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy to be welded.

2.4 STAINLESS STEEL

A. Bar Stock: ASTM A 276, Type 302 or 304.

B. Plate: ASTM A 167, Type 302 or 304.

2.5 ALUMINUM

A. Extruded Bars and Shapes: ASTM B 221, alloys as follows:

1. 6061-T6 or 6063-T6 for bearing bars of gratings and shapes.
2. 6061-T1 for grating cross bars.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, alloys as follows:

1. 6061-T6 for platforms.
2. 6061-T4 for treads.

C. Aluminum Rivets: ASTM B 316, alloy 6053-T4 or 6061-T6.

D. Aluminum Sheet for Expanded Aluminum Grating: ASTM B 209, alloy 5052-H32.

E. Fasteners for Aluminum Gratings:

1. Use fasteners made of same basic metal as fastened metal except use galvanized fasteners complying with ASTM A 153 for exterior aluminum units, unless otherwise indicated.
2. Do not use metals that are corrosive or incompatible with metals joined.

2.6 GROUT AND ANCHORING CEMENT

A. Nonshrink Nonmetallic Grout.

1. Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621 specifically recommended by manufacturer for interior and exterior applications of type specified in this Section.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bonsal Construction Grout; W.R. Bonsal Co.
2. Diamond-Crete Grout; Concrete Service Materials Co.
3. Euco N-S Grout; Euclid Chemical Co.
4. Kemset; Chem-Masters Corp.
5. Crystex; L & M Construction Chemicals, Inc.
6. Masterflow 713; Master Builders.
7. Sealtight 588 Grout; W.R. Meadows, Inc.
8. Sonogrout; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
9. Stoncrete NM1; Stonhard, Inc.

2.7 FASTENERS

A. General:

1. Provide zinc-coated fasteners for exterior use or where built into exterior walls.
2. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

C. Lag Bolts: Square head type, FS FF-B-561.

D. Machine Screws: Cadmium plated steel, FS FF-S-92.

E. Wood Screws: Flat head carbon steel, FS FF-S-111.

F. Plain Washers: Round, carbon steel, FS FF-W-92.

G. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.

H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.8 PAINT

A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing min. 94% zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

D. Zinc Chromate Primer: FS TT-P-645.

2.9 CONCRETE FILL AND REINFORCING MATERIALS

A. Concrete Materials and Properties: Comply with requirements of Division 3 section "Cast-In-Place Concrete" for normal weight, ready-mix concrete with min. 28-day compressive strength of 2,500 psi, 440 lb. cement per cu. ft. minimum, and W/C ratio of 0.65 max., unless higher strengths indicated.

B. Nonslip Aggregate Finish: Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

C. Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.

2.10 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but min. needed to comply with performance requirements indicated.

1. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.
2. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from following max. change (range) in ambient temperature in design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners; base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100ºF.

D. Shear and punch metals cleanly and accurately; remove burrs.

E. Ease exposed edges to radius of approximately 1/32", unless otherwise indicated.

1. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with AWS recommendations and following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible.

1. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts.

2. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure.

1. Fabricate and space anchoring devices to provide adequate support for intended use.

J. Shop Assembly:

1. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.
2. Disassemble units only as necessary for shipping and handling limitations.
3. Use connections that maintain structural value of joined pieces.
4. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints exposed to weather in manner to exclude water, or provide weep holes where water may accumulate.

2.11 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 80 steel pipe.

1. Cap bollards with 1/4" min. thickness steel plate.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4" thick steel plate welded to bottom of sleeve.

2.12 DOWNSPOUT BOOTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Barry Pattern and Foundry Co., Inc.
2. Neenah Foundry Co.; Catalog Series 4900.
3. US Foundry.

B. Size:

1. Width and depth required to match size of downspouts, but no less than 8”x8”.
2. Height minimum 30”, install min. 1'-0" above finish grade.
3. Spill to grade on precast concrete splash block.
4. Extend boot underground and tie into underground storm drainage piping.
5. Shape of end of boot required to match storm drain line.
6. Apply offset to accommodate for footings.

2.1 METAL LADDERS

A. General:

1. Fabricate ladders for locations shown, with dimensions, spacings, details and anchorages indicated.
2. Comply with ANSI A14.3.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, steel channels C4 x 5.4 with smoothed legs.
3. Rungs: 1-inch-diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Harsco Industrial IKG, a division of Harsco Corporation.
        2) W.S. Molnar Company.

7. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Finish: Factory primed, field finished.
10. Prime ladders, including brackets and fasteners, with zinc-rich primer or as specified in Section 09 9000 "Paints and Coatings."

2.2 MISCELLANEOUS STEEL TRIM

A. Provide shapes and sizes indicated for profiles shown.

1. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges.
2. Use concealed field splices wherever possible.
3. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

B. Galvanize miscellaneous framing and supports in following locations:

1. Exterior locations.
2. Interior locations where indicated.

2.3 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.4 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by hot-dip process comply with following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled,
3. pressed, and forged shapes, plates, bars, and strip 0.0299" thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated.

1. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.
2. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

2.5 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to system established by Aluminum Association for designating aluminum finishes.

1. As Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
2. Class I Clear Anodized Finish: AA-M12C22A41 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class I Architectural: clear film thicker than 0.7 mil) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and

miscellaneous items having integral anchors to be embedded in concrete or masonry construction; coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

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

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals with heavy coat of bituminous paint or zinc chromate primer.

3.3 INSTALLATION OF METAL BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLATION OF EXPANSION JOINT COVERS

A. Set covers in accordance with manufacturer's printed instructions or drawings in locations indicated.

B. Provide concealed secure anchorage with anchors recommended for substrate encountered; min. 2'-0" o.c.

C. Keep joint free of all debris and materials which would prevent movement.

3.5 REPAIRS

A. Touchup Painting:

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

    a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9000 “Paints and Coatings.”

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5000

SECTION 05 5213 - PIPE AND TUBE RAILINGS

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. All interior and exterior rails including those marked as rail, handrail, guardrail.
2. Steel railings.
3. Aluminum railings.
4. Stainless Steel pipe railings. Shop fabricated all welded construction.
5. Interior and exterior rails, handrails and grip rails.

1.3 COORDINATION

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

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

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

1.4 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Handrail brackets.
4. Nonshrink, nonmetallic grout.
5. Anchoring cement.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Welding certificates.

C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design railings, including attachment to building construction.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Stainless Steel: 60 percent of minimum yield strength.

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and 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.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

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

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

D. Plates, Shapes, and Bars: ASTM A36/A36M.

E. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.4 ALUMINUM RAILINGS

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B221, Alloy 6063-T5/T52.

C. Plate and Sheet: ASTM B209, Alloy 6061-T6.

D. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

E. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.5 STAINLESS STEEL

A. Pipe: ASTM A 312/A 312M, Grade TP 304.

1. Schedule 40 wall thickness 0.140 unless otherwise indicated.

B. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

C. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.6 WALL MOUNT HANDRAIL BRACKETS

A. Post mount handrail bracket

1. Rotates to any angle.
2. Concealed fasteners.
3. 1-1/4” rose.
4. Provide extended Bracket arm as needed.
5. Adapters : Vertical/Post , round /flat , as needed.

B. Manufactures

1. Wagner – MB3301P (Basis of design).
2. Julius Blum.

2.7 FASTENERS

A. General: Provide the following:

1. Type 304, Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

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

2.8 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 9000 "Paints and Coatings."

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.9 FABRICATION

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

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Stainless Steel Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Form changes in direction as follows:

1. By flush bends or by inserting prefabricated flush-elbow fittings.

K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Flanges, Fittings, and Anchors: Provide wall flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.10 FINISHES, GENERAL

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

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.11 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.

1. Exterior Railings: SSPC-SP 6/NACE No. 3.
2. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
3. Other Railings: SSPC-SP 3.

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with primers specified in Section 09 9000 "Paints and Coatings" unless indicated.

2.12 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines, or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

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

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

D. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 2-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket with concealed bolt anchorage.no exposed fasterner.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 REPAIR

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9000 "Paints and Coatings."

3.7 CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 5213

SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood blocking and nailers.
3. Wood grounds.
4. Wood sleepers.
5. Plywood backing panels.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 PROJECT CONDITIONS

A. Coordination:

1. Fit carpentry work to other work; scribe and cope as required for accurate fit.
2. Coordinate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

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

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Mixed southern pine or southern pine; SPIB.
4. Spruce-pine-fir; NLGA.
5. Hem-fir; WCLIB or WWPA.
6. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.
9. Western woods; WCLIB or WWPA.

B. Other Framing: No. 2 grade of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Southern pine or mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (north); NLGA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 INSTALLATION OF PLYWOOD BACKING PANELS

A. Telephone Back Board:

1. Provide a minimum of two separate telephone back boards in locations shown on Electrical Drawings; If not shown as directed by Architect.
2. Unless noted otherwise backboards to be 3/4" thick plywood; 8'-0" x 8'-0", mounted on face of wall at 8" above finished floor.

    a. Attach to wall with 1/4" toggle bolts at 1'-0" on center along perimeter of plywood
    b. Field paint back board with primer and two coats of black paint.

B. Computer Back Board:

1. Provide a minimum of two separate computer back boards in locations shown on Electrical Drawings; If not shown as directed by Architect.

2. Unless noted otherwise backboards to be 3/4" thick plywood; 8'-0" x 8'-0", mounted on face of wall at 8" above finished floor.

a. Attach to wall with 1/4" toggle bolts at 1'-0" on center along perimeter of plywood.
b. Field paint back board with primer and two coats of black paint.

3.5 PROTECTION

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

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1053

SECTION 06 2020 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Types of finish carpentry work in this Section include:

1. Interior running and standing trim.
2. Plywood paneling.

B. Finish carpentry includes carpentry work exposed to view, non-structural, and not specified as part of other sections.

1.3 DEFINITIONS

A. Finish carpentry includes carpentry work exposed to view, non-structural, and not specified as part of other sections.

B. MDF: Medium-density fiberboard.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

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

B. Samples: Submit following samples for each species and cut or pattern of finish carpentry.

1. Interior standing and running trim 2'-0" long x full width, unfinished.
2. Plywood paneling: 2'-0" long x panel width.

C. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials.

D. Dip Treatment: For each type specified, include certification by treating plant stating chemical solutions used, submersion period and conformance with specified standards.

E. Fire-Retardant Treatment: Include certification by treating plant indicating type of chemicals used and fire performance characteristics achieved.

1.6 QUALITY ASSURANCE

A. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification.

1. Omit marking from surfaces to receive transparent finish.
2. Submit mill certificate that material inspected and graded in accordance with requirements if not marked on concealed surface.

B. Fire-Retardant Marking:

1. Mark each unit of fire-retardant treated lumber and plywood with classification marking of Underwriters Laboratories, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction.
2. Place marking on surfaces not exposed after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed finish carpentry within 1.0% tolerance of optimum moisture content, from date of installation through remainder of construction period.

1. Fabricators of woodwork determine optimum moisture content and required temperature and humidity conditions.

C. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCT QUALITY STANDARDS

A. Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of respective grading and inspecting agency for species and product indicated.

B. Plywood Standard: Comply with PS 1/ANSI A199.

C. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.

D. Hardwood Plywood Standard: Comply with PS 51.

E. Woodworking Standard: Where indicated for specific product comply with specified provision of following:

1. Architectural Woodwork Institute (AWI) "Quality Standards."
2. Glued-up Lumber Standard: Comply with PS 56.

2.2 MATERIALS

A. General:

1. Nominal sizes indicated, except as shown by detailed dimensions.
2. Provide dressed or worked and dressed lumber, as applicable, manufactured to actual sizes required by PS 20 or to actual sizes and pattern shown, unless otherwise indicated.

B. Moisture Content of Softwood Lumber: Provide kiln-dried (KD) lumber having max. moisture content from time of manufacture until time of installation as required by applicable grading rules of respective grading and inspecting agency for species and product indicated.

C. Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having moisture content from time of manufacture until time of installation within ranges required in referenced woodworking standard.

D. Lumber for Transparent Finish (Stained or Clear): Use pieces made of solid lumber stock.

E. Interior Finish Carpentry:

1. Standing and Running Trim for Transparent Finish: manufactured to sizes and patterns (profile) shown from selected First Grade lumber (NHLA); complying with following

grade requirements of referenced woodworking standard, for quality of materials and manufacture:

a. Grade: Custom.
b. Standing and Running Trim for Painted Finish: Grade for Sizes and Patterns: Northern Poplar.
c. Standing and Running Trim for Transparent Finish: Grade for Sizes and Patterns: Red Oak plain sliced – F.A.S. (First and Second Grade).

2. Hardwood Plywood Stock Panels: Provide manufacturer's stock hardwood plywood panels complying with applicable requirements of PS 51 for species and grade of face veneers and backing, adhesive, construction, thickness, panel size, and finish.

a. Face Veneer Species: **VERIFY WITH FINISH SCHEDULE**

1) Plain sliced Red Oak.

a) Grade: Premium.

b. Backing Veneer Species:

1) Any hardwood compatible with face species.

c. Construction:

1) MDF Core fire retardant.

d. No. of Plies:

1) 3.

e. Thickness:

1) 1/2" and 3/4”.

f. Plywood Type (Fire Rated):

1) Type II (Interior).

g. Face Pattern:

1) Plain (no grooves) with veneer edge matched within each panel face to comply with type of match required by referenced product standard.

h. Face Veneer Matching (Panel-to-Panel):

1) No match.

i. Finish:

1) Polish sanded.

F. Miscellaneous Materials:

1. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of type, size, material and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.

a. Where finish carpentry exposed on exterior or in areas of high relative humidity, provide fasteners and anchorages with hot-dipped zinc coating (ASTM A 153).

2.3 WOOD TREATMENT

A. Preservative treatment: Following basic fabrication provide 3-minute dip treatment of finish carpentry items indicated to receive preservative treatment in 5% solution of pentachlorophenol, with vehicle not interfering with finish application and producing min. effect on appearance.

1. Apply brush coat on surfaces cut after treatment.

B. Fire-Retardant Treated Wood: Where wood indicated as fire treated, provide materials complying with applicable standards for pressure impregnation with fire-retardant chemicals and with following requirements.

1. AWPA Standard for Lumber: AWPA C 20 except as otherwise indicated.
2. AWPA Standard for Plywood: AWPA C 27 except as otherwise indicated.
3. Kiln-dry treated wood to max. moisture content of 15% for plywood, 19% for lumber.
4. Inspect each piece of lumber and plywood or each unit of finish carpentry after drying; do not use twisted, warped, bowed or otherwise damaged or defective wood.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

B. Pre-Installation Meeting:

1. Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work.
2. Include in meeting Contractor, Architect and other Owner Representatives (if any), Installers of finish carpentry, wet work including plastering (if any), other finishes, painting, mechanical work and electrical work, and firms and persons responsible for continued operation (whether temporary or permanent) of HVAC system required to maintain temperature and humidity conditions.
3. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

3.3 INSTALLATION

A. Discard unsound, warped, bowed, or twisted materials, improperly treated or inadequately seasoned materials or if units too small to fabricate work with min. of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

B. Install work plumb, level, true and straight with no distortions.

1. Shim as required using concealed shims.
2. Install to tolerance of 1/8" in 8'-0" for plumb and level horizontal surfaces and with 1/16" max. offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Standing and Running Trim:

1. Install with min. number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Stagger joints in adjacent and related members.
3. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Window stools shall be solid wood 1-1/4” thick, plywood or other man made panels not acceptable.

E. Fire-Retardant Treated Wood:

1. Handle, store and install in accordance with manufacturer's directions and as required to meet required classification or rating.
2. Provide special fasteners, moldings, adhesives and other accessories as tested and listed for type of fire-retardant materials indicated.

F. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates.

1. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation.

2. Except where prefinished matching fasteners heads required, use fine finishing nail for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent indicated.

G. Attach siding to framing to comply with siding manufacturer's instructions including requirements for type, size, materials, location and spacing of fasteners.

H. Hardwood Plywood Paneling:

1. Where grain character or color variations are noticeable, select and arrange panels on each wall for best match of adjacent panels.
2. Install with uniform, tight joints between panels.
3. Attach panels to supports with panel adhesive and temporary bracing or fasteners, plus nailing where covered by moldings (if any), in accordance with manufacturer's instructions for concealed-fastener installation.
4. Apply panel adhesive on supports, immediately prior to panel placement and nailing.

3.4 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually.

1. Where not possible to repair properly, replace woodwork.
2. Adjust joinery for uniform appearance.

B. Clean finish carpentry work on exposed and semi-exposed surfaces.

1. Touch-up shop-applied finishes to restore damaged or soiled areas.
2. Refer to Division 9 sections for final finishing of installed finish carpentry work.

C. Protection: Installer of finish carpentry work advise Contractor of final protection and maintained conditions necessary to ensure that work is without damage or deterioration at time of acceptance.

END OF SECTION 06 2020

SECTION 06 4023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural Wood Cabinets.
2. Cabinet Tops; Solid Surface, Plastic Laminate. Chemical Resistant Laminate.
3. Window Sills.
4. Closet Shelving.
5. Miscellaneous Shelving.
6. Finishing of interior architectural woodwork.
7. Cabinet Hardware Schedule.

1.2 COORDINATION

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

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

1. Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work.
2. Include Contractor; Architect and other Owner Representatives (if any); Installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work; and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system required to maintain temperature and humidity conditions.
3. Proceed with woodwork installation only when all concerned agree that required ambient conditions can be maintained.

C. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.

D. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.
4. Wood-Preservative Treatment:

    a. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
    b. Indicate type of preservative used and net amount of preservative retained.
    c. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.

5. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
6. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings:

1. Include the following:

    a. Dimensioned plans, elevations, and sections.
    b. Attachment details.

2. Show details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

C. Samples, submit the following:

1. Lumber with or for transparent finish; 6" x 3/4" x 18", for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from, flitches to be used for transparent finished woodwork.
3. Wood veneer faced panel products, with or for transparent finish, finished, 8" x 10", for each species and cut.
4. Lumber or panel products with factory-applied opaque finish, 8" x 10", for each finish system and color.
5. Plastic laminate, 8" x 10" for each type, color, pattern and surface finish.
6. Flexible wood paneling, 8" x 10" for each type, pattern and surface finish.
7. Exposed cabinet hardware, one unit of each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Product Certificates: For the following:

1. Composite wood products.
2. Adhesives.

C. Evaluation Reports: For preservative-treated and fire-retardant-treated wood materials, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. AWI Quality Standard: Comply with applicable requirements of Architectural Woodwork Institute (AWI), "Architectural Woodwork Quality Standards", except as otherwise indicated.

1. Arrange for architectural woodwork with sequence matched wood veneers to be produced by single firm. Include veneering of wood doors in single-firm production, where veneer matching extends across wood doors.

C. Coordination: Distribute copies of approved scheduled for cabinet hardware specified in Section 08 7100 “Door Hardware” to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

D. Installer Qualifications: Arrange for installation of architectural woodwork by firm demonstrating successful experience in installation of architectural woodwork items similar in type and quality to those required for Project.

E. Installer Qualifications: Arrange for installation of architectural woodwork items by same firm which fabricated them.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

D. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.8 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

C. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

1. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

2.2 ARCHITECTURAL WOODWORK MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. High Pressure Decorative Laminates:

a. Consoweld Corp.
b. Formica Corp.
c. Lamin-Art.
d. Micarta Div., Westinghouse Electric Corp.
e. Nevamar Corp.
f. Pioneer Plastics, Div. of LOF Plastics, Inc.
g. Ralph Wilson Plastics Co.

2. Flexible Wood Paneling:

a. National Products Co.
b. Flexible Materials, Inc.
c. Forms + Surfaces.

3. Solid Surfacing:

a. Corian; Dupont.
b. Gibraltar; Ralph Wilson Plastics Co.
c. Avonite.
d. Formica.

2.3 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

2.4 ARCHITECTURAL CABINETS, WOOD

A. Quality Standard: Comply with AWI Section 400 and its Division 400A "Wood Cabinets."

B. Wood Cabinets for Transparent Finish: Comply with the following requirements:

1. Grade:

a. Custom, no particleboard permitted. All plywood veneer core.

2. Type of Cabinet Construction:

a. As indicated.

3. Wood Species for Exposed Surfaces:

a. Provide White Birch Plain Sliced.
b. Grain Matching:

1) Run and match grain vertically for doors.
2) Run and match grain horizontally for drawer fronts.
3) As indicated.

c. Matching of Veneer Leaves:

1) A-Face book match plain sliced Veneer Core back #2.

d. Comply with veneer and other matching requirements indicated for Blueprint matched paneling.
e. Stain Color: march color selected for Flush Wood Doors.

4. Wood Species for Semi-Exposed Surfaces: Match species and cut indicated for exposed surfaces.
5. Concealed Members:

a. Solid Lumber or Plywood: Any species, with no defects affecting strength or utility.
b. Particleboard: Not permitted.
c. Hardboard: ANSI A135.4, Class 1, tempered.

6. Drawers:

a. Construct drawers using Dovetail, French dovetail, lock shoulder. Or dowels spaced 3” apart.
b. Drawer bottoms shall be set into sides and front 1/4” deep grove with min 3/8” standing shoulder, Drawer bottom 1/4” plywood veneer face.

2.5 CABINET TOPS PLASTIC LAMINATE

A. Quality Standard: Comply with AWI Section 400 and its Division 400C.

B. Type of Top:

1. High Pressure Decorative Laminate:

a. Grade:

1) Premium.
2) Custom.

b. Laminate Cladding for Horizontal Surface: High pressure decorative laminate complying with NEMA LD 3 and as follows:

1) Colors, Patterns, and Finishes: As indicated or, if not otherwise indicated, as selected from laminate manufacturer's standard products in the following categories:

a) Solid colors.
b) Patterns.
c) Not less than 2 colors will be selected.

2) Colors, Patterns, and Finishes: Match Architect's sample.
3) Grade: GP-50 (0.050" nominal thickness).

a) Grain Direction: Parallel to longest dimension.

4) Edge Treatment:

a) Same as laminate cladding on horizontal surface.
b) Lumber edge for transparent finish matching wood species and cut on cabinet surfaces.
c) As indicated.

2.6 CABINET TOPS SOLID SURFACE

A. Solid Plastic/Solid Surface:

1. Mineral -filled acrylic resin composition.

a. Thickness:

1) 1/2", sizes, shapes indicated.

b. Colors, Finishes:

1) From Price Groups: (C).
2) Not less than 2 colors will be selected.

c. Edge Treatment:

1) Square where abutting other surfaces, with edged rounded to 1/8" radius where exposed.
2) Square where abutting other surfaces, fully rounded (bullnose) where exposed.
3) Square where abutting other surfaces, formed to profiles indicated where exposed.

d. Backsplash: 1/2" thick by height indicated, or if not indicated, 4", with 3/4" radius at top.
e. Lavatories: Integral with top made of same material as top. Size: 13” x 18” x 5-1/4” deep. Color selected from manufacturers standard.
f. Drill holes in countertops for plumbing and accessories at shop.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. DuPont “Corian.”
    b. Avonite.
    c. Wilson Art “Gibraltar.”

2.7 WINDOW SILLS

A. Solid surface/solid plastic. Mineral-filled acrylic resin composition.

1. Thickness:

    a. 1/2” size and shapes indicated.

2. Colors:

    a. As selected form sample up to and including price group 5.
    b. Not less than 2 colors will be selected.

3. Edge Treatment:

    a. Square where abutting other surfaces, with edged rounded to 1/8" radius where exposed.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. DuPont “Corian.”
    b. Avonite.
    c. Wilson Art “Gibraltar.”

2.8 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.

1. Ease edges to 1/16" radius, for corners of cabinets and edges of solid wood (lumber) members less than 1" in nominal thickness, 1/8" radius for edges of rails and similar members over 1" in nominal thickness.

C. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible.

1. Disassemble components only as necessary for shipment and installation.

2. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Pre-Cut Openings:

1. Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items.
2. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape.
3. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

E. Measurements:

1. Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.
2. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

2.9 PRESERVATIVE-TREATED-WOOD MATERIALS

A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).

2.10 FIRE-RETARDANT-TREATED WOOD MATERIALS

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

1. Use treated materials that comply with requirements of the Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.

2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less in accordance with ASTM E84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Arauco North America.
   b. Timber Products Company.

2. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
3. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1, except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.

2.11 FABRICATION

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.

1. Ease edges to 1/16" radius, for corners of cabinets and edges of solid wood (lumber) members less than 1" in nominal thickness, 1/8" radius for edges of rails and similar members over 1" in nominal thickness.

C. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Pre-Cut Openings:

1. Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items.
2. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape.
3. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

E. Measurements:

1. Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.
2. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

2.12 FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

C. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.

D. General: The entire finish of interior architectural woodwork is work of this section, regardless of whether factory-applied or applied after installation.

E. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory; defer only final touch-up, cleaning and polishing for time after delivery and installation.

F. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing of concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

G. Transparent Finish for Woods: Comply with requirements indicated below for grade, finish system, staining, effect and sheen.

1. Grade: Custom.
2. Finish: AWI System #1 standard lacquer.
3. Staining: To match approved sample for color. Exterior of cabinet.
4. Staining Interior of cabinet and interior of drawers Clear No stain.
5. Effect: Closed grain (filled finish).
6. Sheen: Satin-medium rubbed effect.

2.13 CABINET HARDWARE AND ACCESSORY MATERIALS

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items which are specified in Division-8 section "Door Hardware".

B. Cabinet Hardware Schedule: Refer to schedule at end of this section for cabinet hardware required for architectural cabinets.

C. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

D. Hardware Finishes: Comply with BHMA 1301 for finishes indicated by BHMA Code Numbers or if not otherwise indicated, provide finishes complying with requirements indicated below:

1. For exposed hardware comply with requirements indicated for finish and base indicated by BHMA Code Number below:

a. 626.

2. For concealed hardware provide manufacturer's standard finish which complies with product class requirements of ANSI/BHMA A156.9.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

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

3.2 INSTALLATION

A. Install woodwork plumb, level, true and straight with no distortions.

1. Shim as required using concealed shims.
2. Install to tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.

B. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

1. Seal cabinet, tops and backsplash to walls using sealant ready to receive wall paint.

C. Pressure Treated Wood: Handle, store, and install pressure treated wood in compliance with recommendations of chemical treatment manufacturer including those for adhesives, where required for installation.

1. For preservative treated lumber cut or drilled in field, treat cut ends with preservative solution used for original treatment by brushing, spraying, dipping or soaking; as required by AWPA M4.

D. Anchor woodwork to anchors or blocking built-in or directly attached.

1. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation.
2. Except where prefinished matching fasteners heads required, countersink fine finishing nails for exposed nailing and fill flush with woodwork, matching final finish where transparent finish indicated.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.

1. Stagger joints in adjacent and related members.
2. Cope at returns, miter at corners and comply with referenced Quality Standards for joinery.

F. Cabinets:

1. Install without distortion so that doors and drawers fit openings properly and are accurately aligned.
2. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
3. Complete the installation of hardware and accessory items as indicated.
4. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
5. Unless otherwise indicated, anchor cabinets with 1/4” fasteners of type appropriate for substrate, max. 12" o.c., min. 2 each unit.

    a. Wall-hung Units: One row top, one row bottom.
    b. Base cabinets: One row top.
    c. Floor set cabinets over 5'-0" high: One row top.
    d. At vent hood provide finished cover matching cabinets, from top of upper cabinet to underside of ceiling to cover the exhaust vent pipe.

G. Tops: Anchor securely to base units and other support systems as indicated.

1. Install plastic grommets where indicated, 2" dia. unless otherwise indicated, in cleanly bored holes.

H. Paneling:

1. Anchor paneling to supporting substrate with concealed panel hanger clips, and by blind nailing on back-up strips, splined-connection strips, and similar associated trim and framing.

2. Do not face-nail, unless otherwise indicated.

I. Flexible Wood Paneling:

1. Anchor paneling to supporting substrate with manufacturer's recommended adhesive, and by blind nailing on back-up strips or similar associated trim and framing.
2. Do not face-nail, unless otherwise indicated.

J. Shelving: Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.

K. Finish Hardware Installation:

1. Supplier to mark each item of hardware for location.

a. Protect markings until each item installed.
b. If any item of hardware delivered to job not marked, return to supplier for marking before attempting to install.

2. Install and make adjustments for correct working order.
3. Replace hardware damaged by improper adjustment or abuse, at no additional cost to Owner.
4. Fit all surface applied hardware.
5. Provide clean, sized and placed mortises and drilled holes for all mortise hardware such as lock sets, flush bolts and pivots.
6. After hardware installation, protect exposed surfaces from wear and abuse with heavy paper and masking tape; maintain until job completion.
7. Center kickplates at bottom of doors and provide same margin at bottom as at sides.
8. Remove all hardware, except that which is primed for painting, before painter's finish applied and replace and readjust for function after painter's finish completed and dried hard.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces; touch-up shop-applied finishes to restore damaged or soiled areas.

D. Complete finishing work specified as work of this Section, to whatever extent not completed at shop or prior to installation of woodwork.

E. Refer to the Division 9 sections for final finishing of installed architectural woodwork.

F. Provide final protection and maintain conditions, in manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of Final Acceptance.

3.4 CABINET HARDWARE SCHEDULE

A. For each 3/4" thick hinged door leaf:

1. 1 pr. hinges (1-1/2 pair if door height over 3'-6"):

a. Blum 71M2550 x 175L6600.22.
b. Grass 1006 x G/FFAL 2.6.
c. Lamp 430-C46/19 x 430P4A32.

2. 1 pull:

a. Stanley 4484 x US26D.
b. Epco MC-402-4 x US26D.
c. Colonial 753.

3. 1 catch (inactive leaf of locked pair):

a. Amerock BP3675-2G.
b. Epco Co. 1016.
c. Ives 2.

4. 1 cabinet lock (if shown) millwork manufacturer provide Olympus 100 Series.

B. For each drawer:

1. 1 drawer guide set:

a. Hafele – EC 437SC.
b. Grass – 3215.
c. Knape & Vogt 1284.

2. 1 pull (2 if drawer width more than 24"):

a. Stanley 4484 x US26D.
b. Epco MC-402-4 x US26D.
c. Colonial 753.

3. 1 lock (where shown) millwork manufacturer provide Olympus 200 series.

C. For adjustable shelves in cabinetwork:

1. Standards:

a. Grant 120.
b. Lamp SP-1820.
c. Knape & Vogt 255.

2. Brackets:

a. Grant 21.
b. Lamp SPB-20.

c. Knape & Vogt 256.

D. For wall mounted shelves:

1. Standards:

a. Lamp SP-1820.
b. Knape & Vogt 80 x length required x anochrome.

2. Brackets:

a. Lamp SPB-20.
b. Knape & Vogt 180 x length required x anochrome.

3. Shelf Supports:

a. Hager 1796.
b. Lamp BT-380.
c. Stanley 796.

END OF SECTION 06 4023

SECTION 07 1326 - SELF-ADHERING SHEET WATERPROOFING FOR ELEVATOR PIT

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. Modified bituminous sheet waterproofing.
2. Prefabricated drainage composite
3. Protection board.
4. Accessories.
5. Rubberized-asphalt sheet waterproofing at vertical walls of elevator pit.
6. HDPE sheet waterproofing beneath concrete slabs and footings of elevator pit.

B. Related Requirements:

1. Section 033000 "Cast-In-Place Concrete" for elevator pit.

1.3 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society for Testing and Materials (ASTM)

1. C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
2. D 412 Standard Test Methods for Rubber Properties in Tension
3. D 570 Standard Test Method for Water Absorption of Plastics
4. D 882 Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
5. D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
6. D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel)
7. D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
8. D 3767 Standard Practice for Rubber - Measurements of Dimensions
9. D 5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
10. E 96 Standard Test Methods for Water Vapor Transmission of Materials
11. E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of 20 years’ experience in the production of sheet membrane waterproofing.

B. Installer Qualifications: A firm that has at least 5 years’ experience in the application of this type of waterproofing material and is approved by waterproofing manufacturer for installation of waterproofing required for this Project.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer’s instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

2. Protect mastic and adhesive from moisture and potential sources of ignition.
3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

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

1. Warranty includes removing and reinstalling protection board or drainage panels.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course or molded-sheet drainage panels from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

B. Basis of Design Product: Subject to compliance with requirements, provide Grace Construction Products; Bituthene 3000/Low Temperature Membrane or comparable product by one of the following:

1. Carlisle Coatings & Waterproofing Inc.
2. Henry Company.
3. W.R. Meadows, Inc.

C. Physical Properties For Bituthene 3000/Low Temperature Membrane:

Property	Test Method	Typical Value
Color		Dark gray-black
Thickness	ASTM D 3767 Method A	1.5 mm (0.060 in.) nominal
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -43°C (-45°F)	ASTM D 1970	Unaffected
Tensile Strength, Membrane Die C	ASTM D 412 Modified[1]	2240 kPa (325 lbs/in.^{2}) minimum
Tensile Strength, Film	ASTM D 882 Modified[1]	34.5 MPa (5,000 lbs/in.^{2}) minimum
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 Modified[1]	300% minimum
Crack Cycling at -32°C (-25°F), 100 Cycles	ASTM C 836	Unaffected
Lap Adhesion at Minimum Application Temperature	ASTM D 1876 Modified[2]	700 N/m (4 lbs/in.) – Bituthene 3000 880 N/m (5 lbs/in.) – Low Temp
Peel Strength	ASTM D 903 Modified[3]	1576 N/m (9 lbs/in.)
Puncture Resistance, Membrane	ASTM E 154	222 N (50 lbs) minimum
Resistance to Hydrostatic Head	ASTM D 5385	60 m (200 ft) of water
Permeance	ASTM E 96, Section 12 – Water Method	2.9 ng/m^{2}sPa (0.05 perms) maximum
Water Absorption	ASTM D 570	0.1% maximum

Footnotes:

- The test is run at a rate of 2 in. per minute.
- The test is conducted 15 minutes after the lap is formed and run at a rate of 2 in. per minute at 25 deg F.
- The 180° peel strength is run at a rate of 12 in. per minute.

2.3 ADHESIVE-COATED HDPE SHEET WATERPROOFING

A. Bonded HDPE or Polyethylene Sheet for Blindside Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane consisting of either an HDPE film coated with pressure-sensitive adhesive and protective release liner, total 46-mil thickness, or a cross-laminated film of low- and medium-density polyethylene, coated with a modified asphalt layer

and a nonwoven geotextile-fabric final layer, total 95-mil thickness; with the following physical properties:

1. Basis of Design product: Subject to compliance with requirements, provide Grace Construction Products; Preprufe 300R or comparable product by one of the following:

    a. W.R. Meadows, Inc.

2. Tensile Strength, Film: 2000 psi minimum; ASTM D 412.
3. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D 1970.
4. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D 903, modified.
5. Lap Adhesion: 2.5 lbf/in. minimum; ASTM D 1876, modified.
6. Hydrostatic-Head Resistance: 231 feet; ASTM D 5385, modified.
7. Puncture Resistance: 200 lbf minimum; ASTM E 154.
8. Water Vapor Permeance: 0.01 perms (0.6 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
9. Water Absorption: 0.5 percent maximum; ASTM D 570.

2.4 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.

1. Basis of Design Product: Grace Waterproofing Products; Primer B2 or Primer B2 LVC.

C. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

1. Grace Construction Products; Bituthene Liquid Membrane, or equal.

D. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.

E. Tape: Adhesive tapes recommended by waterproofing manufacturer.

1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.

    a. Grace Construction Products; Preprufe Tape, or equal.

F. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

G. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

H. Double-Sided Tape: Two-sided highly aggressive tape, 2 inches wide for attachment of drainage panels and insulation board.

1. Basis of Design Product: Grace Construction Products; Prepufe Detail Tape.

2.5 PROTECTION COURSE

A. Asphalt Hardboard: Multi-ply, semi-rigid board, composed of a mineral-fortified asphaltic core formed between two outside layers of asphalt-impregnated fiberglass mat, weathercoated and covered with a polyethylene anti-stick sheet. Performance based specification shall have the following characteristics based on ASTM D6506.

a. Basis of Design Product: W.R. Meadows, Inc.; Type 3 Protection Course.

B. Fan folded, with a core of extruded-polystyrene board insulation faced on one side with plastic film, nominal thickness 1/4 inch, with compressive strength of not less than 8 psi per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.

a. Basis of Design Product: The Dow Chemical Company; DOW Protection Board III.

C. Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch thick.

a. Basis of Design Product: FOAMULAR Insulating Sheathing, 1.3 pcf density.

D. Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. minimum density, 1-inch minimum thickness.

a. Basis of Design Product: Universal Foam Products, EPS.

2.6 WATERSTOP

A. Waterstop: Hydrophilic non-bentonite waterstop for non-moving concrete construction joints.

a. Basis of Design Product: Grace Waterproofing Products; AdcorTM ES hydrophilic non-bentonite waterstop.
b. Physical properties for grace adcortm es hydrophylic waterstop:

Property	Typical Value
Color	Grey
Size	1.0 in. x ½ in. x 16 ft. (25.4 mm x 12.7 mm x 4.9 m) rolls
Packaging	6 rolls per case
Hydrostatic Head Resistance	70 m (231 ft)
Wet - Dry Cycling [25 Cycles @ 231 ft. (70 m)]	No Effect

Adhesion to Concrete using Adcor ES Adhesive	Excellent

2.7 MOLDED-SHEET DRAINAGE PANELS

A. Hydroduct 200 is a strong preformed, 0.44 in. thick, geocomposite drainage sheet system. It is comprised of a hollow studded polystyrene core, covered on one side with a nonwoven, needle punched polypropylene filter fabric.

B. Basis of Design Product: Subject to compliance with requirements, provide Grace Construction Products; Hydroduct 220 Drainage Composite or comparable product by one of the following:

1. American Hydrotech, Inc.
2. Carlisle Coatings & Waterproofing Inc.

C. Physical Properties for Hydroduct 200:

Property	Typical Value	Test Method
Drainage Core		
Polymer	High impact polystyrene	
Thickness	0.44 in. (11 mm) nominal	ASTM C366 method B
Compressive strength	15,000 lbs/ft2 (718 kPa)	ASTM D1621
Flow rate (gradient 1.0, load 172 kPa)	17 gal/min./ft (211 L/min./m)	ASTM D4716
Geotextile		
Type	Nonwoven	
Polymer	Polypropylene	
Weight	4.0 oz/yd2 (136 g/m2)	ASTM D3776
Tensile strength	100 lbs (445 N)	ASTM D4632
Apparent opening size	100 U.S. sieve (0.21 mm)	ASTM D4751
Flow rate	165 gal/min./ft2 (6724 L/min./m2)	ASTM D4491
CBR puncture	275 lbs (1.22 kN)	ASTM D6241

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade or concrete mud-slab is dry, smooth, and sound; and ready to receive adhesive-coated HDPE sheet.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 INSTALLATION

A. Refer to manufacturer’s literature for recommendations on installation, including but not limited to, the following:

1. Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer.
2. Delay application of membrane until primer is completely dry. Dry time will vary with weather conditions.
3. Seal daily terminations with troweled bead of mastic.
4. Apply protection board and related materials in accordance with manufacturer’s recommendations.

3.4 WATERSTOP INSTALLATION

A. Refer to manufacturer’s literature for recommendations on installation, including but not limited to, the following:

1. Construction Joint:

a. On irregular concrete faces, apply a 1/2 in. bead of Adcor ES Adhesive as bedding for Adcor ES.
b. Secure Adcor ES using masonry nails 11/2 inches - 2 inches long with a washer 3/4 inches in diameter. Hilti EM6-20-12 FP8 shot fired fixings with 1/4 inch nuts and 3/4 inch diameter washers may also be used. Fixings should be spaced at a maximum of 12 inches centers with a minimum spacing that ensures proper contact to substrate.
c. Adcor ES joints should overlap a minimum of 4 inches, ensuring full contact between jointed pieces.
d. Adcor ES can be bent around corners; however, on complex geometry use Adocr ES Adhesive to fill any gaps.
e. Any damaged sections should be removed and repaired with a new section of Adcor ES.
f. Keep Adcor ES dry prior to pouring concrete.

3.5 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

E. Seal edges of sheet-waterproofing terminations with mastic.

F. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

H. Immediately install protection course with butted joints over waterproofing membrane.

1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.6 ADHESIVE-COATED HDPE SHEET-WATERPROOFING APPLICATION

A. Install Bonded blindside sheet waterproofing according to manufacturer’s written instructions.

B. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

C. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

D. Seal penetrations through sheet waterproofing to provider watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

E. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.7 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

3.8 FIELD QUALITY CONTROL

A. Owner will engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.

B. Prepare test and inspection reports.

3.9 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 1326

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Extent of insulation work shown on drawings and indicated by provisions of this Section.

B. Section Includes:

1. Glass-fiber blanket insulation.
2. Loose-fill insulation.

C. Related Requirements:

1. Section 09 2900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Glass-fiber blanket insulation.
2. Loose-fill insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cameron Ashley Building Products.
b. Certainteed; SAINT-GOBAIN.
c. Johns Manville; a Berkshire Hathaway company.
d. Knauf Insulation.
e. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Certainteed; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

C. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Certainteed; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.

c. Knauf Insulation.
d. Owens Corning.

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

D. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

E. Support Net: Nylon woven or non-woven. Designed to support insulation when faced to light gauge framing.

2.2 LOOSE-FILL INSULATION

A. Cellulosic-Fiber Loose-Fill Insulation: ASTM C739, chemically treated for flame-resistance, processing, and handling characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GreenFiber.
b. Hamilton Manufacturing Inc.
c. Nu-Wool Co., Inc.

B. Glass-Fiber Loose-Fill Insulation: ASTM C764, Type I for pneumatic application or Type II for poured application.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Certainteed; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.

2. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

7. Set support net when insulation is left exposed above ceiling. Provide at walls where insulation is exposed above ceiling and where place suspended at joist overhead. Provide at all locations where insulation is only supported from one side

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 2100

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Open-cell spray polyurethane foam insulation.
2. Thermal Barrier Coating: Fire-protective intumescent coatings.
3. Accessories.

1.2 COORDINATION

A. Coordinate the R-Value requirement thickness with the Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each product, for tests performed by qualified testing agency.
2. Research Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.
3. Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

C. Qualification Statements: For Installer.

1. Manufacturer’s certification that installer is qualified to install products being applied.
2. Applicator Qualifications:

    a. Qualified spray polyurethane foam applicator familiar with products being applied.
    b. Minimum 5 years experience in work of this Section.

1.5 QUALITY ASSURANCE

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

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

1.7 DELIVERY, STORAGE AND HANDLING

A. Store materials at temperatures between 35 and 85 degrees F, except store above 70 degrees F for several days before use.

B. Do not store in direct sunlight.

C. Keep containers tightly closed and under dry gas pressure of 2 to 3 PSI after opening.

1.8 PROJECT CONDITIONS

A. Do not install insulation when ambient temperature is below 50 degrees F without approval by product manufacturer.

1.9 SEQUENCING

A. Install insulation after rough plumbing and electrical completed and inspected and other wall penetrations completed.

PART 2 - PRODUCTS

2.1 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 0.4 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Huntsman Building Solutions (formerly Demilec, Icynene, Lapolla) or a comparable product by one of the following:

a. Carlisle Spray Foam Insulation; Carlisle Construction Materials.
b. Gaco; a brand of Firestone Building Products.
c. Henry Company.
d. Johns Manville; a Berkshire Hathaway company.
e. Master Builders Solutions.
f. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company.

2. Surface-Burning Characteristics: Comply with ASTM E84; 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: 450 or less.

3. Fire Propagation Characteristics: Passes NFPA 286 testing as part of an approved assembly.

B. Physical Properties:

1. Aged “R” Value, ASTM C518, 3.9 per inch.
2. Core Density, ASTM D1622, .4-.6 lbs./ft3.
3. Open-Cell Content, ASTM D2856, >94%.
4. Tensile Strength, ASTM D1623, 3 psi.
5. Air Permeance ASTM E283-04 < 0.02L/s/M ² at 4.5 inches
6. Dimensional Stability: 28 days at 160°F, 100%RH, ASTM D2126, 15% max by volume change 3%.
7. Sound Transmission:

    a. ASTM E413-2004, Sound Transmission Class 41.
    b. ASTM E1332-90, Indoor-Outdoor Transmission Class 30.
    c. ASTM C423-02a, Noise Reduction Coefficient 0.10.

8. Moisture Vapor Transmission, ASTM E-96:

    a. 1” - 22 Perms.
    b. 2” - 15 Perms.

9. Flammability, ASTM E970 / >0.12, .19.
10. Flammability, NFPA 259, 1812 BTU / ft, Noise Reduction Coefficient 0.10.

2.2 ACCESSORIES

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

B. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.

1. Thermal Barrier Coating: Fire-protective intumescent coating formulated for application over polyurethane foam plastics, compatible with insulation, and passes NFPA 275 testing as part of an approved assembly.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Flame Control Coatings, LLC.
        2) International Fireproof Technology Inc.
        3) No-Burn, Inc.

4) TPR2 Corporation.

2. Provide performance per IBC 2018, Section 2603.
3. Surface-Burning Characteristics: Comply with ASTM E84; 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.

4. Topcoat: 8- to 12-mil- thick, water-based latex-based paint recommended in writing by intumescent thermal barrier manufacturer as compatible with substrate materials.

2.3 MATERIAL ACCESSORIES

A. Joint Filler Foam: CF 124 Filler Foam by Hilti or equivalent.

B. Joint Sealer: Single component polyurethane type; Sikaflex 1a by Sika Corp. or equivalent.

C. Moisture Detection Paper Strips: MDP Strips by NCFI Polyurethanes.

D. Seam Tape: Butyl Seam Tape by NCFI Polyurethanes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Clean surfaces to receive insulation; remove dirt, sawdust, dust, and debris by blowing with compressed air or vacuuming.

C. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

D. Verify dryness of spaces to receive insulation using moisture detection paper strips.

E. Protect adjacent and underlying surfaces from accidental application using plastic sheeting and masking tape.

F. Apply release agent to face of framing to facilitate removal of foam.

G. Apply filler foam or joint sealer around door and window frames, openings, and perimeter to contain insulation.

H. Cover gaps greater than 2 inches with seam tape or gypsum backer board, then spray insulation over opening.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Apply insulation to average thickness required to achieve minimum R-values indicated on Drawings.

C. Spray insulation to envelop entire area to be insulated and fill voids.

D. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

F. Install thermal barrier material.

1. Do not cover insulation prior to any required spray foam insulation inspections.

G. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.

1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
3. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

H. Trim excess thickness unless it does not interfere with installation of covering materials.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect spray foam insulation installation, including accessories. Report results in writing.

3.4 CLEANING

A. Remove insulation applied to adjacent and underlying surfaces.

3.5 ADJUSTING

A. Patch damaged areas that violate air or moisture seal using joint filler foam or joint sealer; recreate seamless foam membrane to full thickness.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 2119

SECTION 07 2419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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. EIFS-clad drainage-wall assemblies that are field applied over substrate.
2. Water-resistive barrier coatings.

1.3 DEFINITIONS

A. Definitions in ASTM E2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

1. Exterior assembly composed of outer layer forming protective finish coating applied to substrate of construction indicated.
2. Exterior assembly composed of inner layer of glass mesh reinforced sheathing and/or thermal insulation board and outer layer forming protective finish coating. Assembly applied to supporting substrate of construction indicated.

C. IBC: International Building Code.

D. System Manufacturer: Manufacturer of exterior insulation and finish system.

1.4 SYSTEM DESCRIPTION

A. Provide system complying with following performance requirements:

1. Bond Integrity: Free from bond failure within system components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
2. Weathertightness: Resistant to water penetration from exterior into system and assemblies behind it or through them into interior of building which results in deterioration of thermal-insulating effectiveness or other degradation of system and assemblies behind system including substrates, supporting wall construction, and interior finish.
3. Fire Performance Characteristics: Provide materials and construction identical to those tested for following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting agencies acceptable to authorities having jurisdiction:

4. Surfacing Burning Characteristics: Flame spread rating of 25 or less per ASTM E 84 for insulation board and protective finish coats, when each tested individually.
5. Full Scale Fire Test: Test mock-up in form indicated below and representative of completed wall assembly of which system is part, shows no tendency to propagate flame over surface or through finish to core, or for finish to delaminate when vertically mounted exterior face exposed to fire source, per ASTM E 108 modified for testing vertical walls as indicated below:

    a. Provide 2 panels, 6'-0" x 10'-0", consisting of protective finish coating and 4" thickness of insulation applied to 1/2" thick gypsum board, cured for 28 days, with protective finish coating removed to leave surface of insulation exposed on one panel in area 4" high x 24" wide centered 2'-0" above bottom edge of panel.

1.5 BUILDING CODE STANDARDS:

A. Building Code Standards: The provisions of the following building codes apply to work of this section.

1. IBC 2018.

B. Fire Code: The provisions of the following fire codes apply to work of this section

1. NFPA 268, “Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.”

C. EIMA (EIFS Industry Members Association) Standards and Publications

1. 101.01 Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS), Class PB (Modified ASTM C-67).
2. 101.02 Standard Test Method for Resistance to Water Penetration of Exterior Insulation and Finish Systems (EIFS), Class PB (Modified ASTM E-331).
3. 101.03 Standard Test Method for Determining Tensile Adhesion Strength of Exterior Insulation and Finish System (EIFS), and Components, Class PB (Modified ASTM C-297).
4. 101.86 Standard Test Method for Resistance of Exterior Insulation and Finish Systems (EIFS), Class PB, to the Effects of Rapid Deformation (Impact).
5. 105.01 Standard Test Method for Alkali Resistance of Glass Fiber Reinforcing Mesh for Use in Exterior Insulation and Finishing Systems (EIFS), Class PB.
6. EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board.

D. Proprietary Specifications

1. 101514 Georgia-Pacific Corporation, “Dens Glass Gold Sheathing”.
2. AATCC-127 Water Resistance: Hydrostatic Pressure Test.

1.6 DESIGN REQUIREMENTS

A. Wind Load: Design for maximum allowable system deflection, normal to the plane of the wall of L/360.

1. Design for wind load in conformance with code requirements.

B. Moisture Control

1. Prevent the accumulation of water behind the EIFS system, either by condensation or leakage through the wall construction, in the design and detailing of the wall assembly.
2. Provide flashing to direct water to the exterior where it is likely to penetrate components in the wall assembly, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, abutments of lower walls with higher walls, above projecting features, and at the base of the wall.
3. Air Leakage Prevention – provide continuity of air barrier system at foundation, roof, windows, doors and other penetrations through the system with connecting and compatible air barrier components to minimize condensation and leakage caused by air movement.
4. Vapor Diffusion and Condensation – perform a dew point analysis of the wall assembly to determine the potential for accumulation of moisture in the wall assembly as a result of water vapor diffusion and condensation. Adjust insulation thickness and/or other wall assembly components accordingly to minimize the risk of condensation. Avoid the use of vapor retarders on the interior side of the wall in warm, humid climates.

C. Color Selection: Color texture to be a light reflectance value of 20 or greater.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.8 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory, including water-resistive barrier coatings.

B. Shop Drawings:

1. Include details for EIFS buildouts.
2. Submit manufacturer’s specifications, details, and installation instructions.
3. Provide project specific details showing each unique condition.
4. Submit complete shop drawings showing installation of system, location of control joints, location of expansion joints, junctions with other materials and location and type of joint sealant.

C. Samples for Verification Purposes: Samples, 2' square, for each finish, color, and texture indicated; prepare samples using same tools and techniques intended for actual work.

1. Incorporate within each sample a typical control joint filled with sealant of color indicated or selected.

1.9 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Installer certificates signed by manufacturer certifying that Installers comply with specified requirements.
2. Applicators certificate of instruction.

B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:

1. EIFS complies with requirements.
2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
3. Accessory products installed with EIFS, including joint sealants, flashing, water-resistive barrier coatings, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Sealant compatibility and test reports from sealant manufacturer certifying that materials forming joint substrates of system tested for compatibility and adhesion with joint sealants; include sealant manufacturer's interpretation of results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

D. Research reports or evaluation reports of model code organization acceptable to authorities having jurisdiction which evidence system's compliance with building code in effect for Project.

1. Manufacturers code compliance report.

E. Product Test Reports: For each EIFS assembly and component, and for water-resistive barrier coatings, for tests performed by a qualified testing agency.

F. Field quality-control reports.

G. Sample Warranty: For manufacturer's special warranty.

1.10 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.11 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Firm regularly engaged in manufacturing products for system indicated and with min. twenty (20) successful experience in applications similar to that required for this Project.
2. Manufacturer to be a member in good standing of EFIS Industry Members Association EIMA).
3. Manufacturing facilities to be ISO 9002 certified.

B. Installer Qualifications: Engage Installer certified in writing by system manufacturer as qualified for installation of systems indicated.

1. Installer to be engaged in application of EIFS for a minimum of three (3) years.
2. Knowledgeable in the proper use and handling of Sto materials and listed by manufacturer as having attended manufacturer’s continuing education.

3. Employ skilled mechanics that are experienced and knowledgeable in EIFS application, and familiar with the requirements of the specified work.
4. Successful completion of minimum of three (3) projects of similar size and complexity to the specified project.
5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with manufacturer's published specifications and details and the project plans and specifications.

C. Insulation board manufacturer requirement.

1. Recognized by manufacturer as capable of producing insulation board to meet system requirements, and hold a valid licensing agreement with manufacturer.
2. Listed by an approved agency.
3. Label insulation board with information required by manufacturer, the approved listing agency and the applicable building codes.

D. Single Source Responsibility: Obtain materials for system from either single manufacturer or from manufacturers approved by system manufacturer as compatible with other system components.

E. Design and Detailing: Encapsulate insulation board by substrate at all locations; separate from exterior of building by thermal barrier having a minimum of a fifteen (15) minute finish rating.

1. Manufacturer/installer responsible for design of system to comply with requirements contained in this section and the information contained on drawings.

F. Manufacturers certificate of compliance with EIMA standards.

G. EPS board manufacturer's certificate of compliance with current edition of EIMA Guideline Specifications for use of expanded polystyrene (EPS) insulation board.

H. Certificate of Compliance: Submit, as part of Shop Drawings, certification from manufacturer of product or materials furnished herein, stating that product(s) and / or material (s) being furnished comply with technical provisions contained herein.

1. Any and all deviations from technical provisions of specifications shall be specifically noted.

I. Producer's Statement of Applicability: Submit from manufacturer or other producer, a written-certified statement that producer reviewed proposed application of product on Project.

1. Statement shall state that producer agrees with or does not object to Architect's specification and Contractor's selection of product for use in work.
2. Statement also state that proposed application of product on project is suitable and proper.

J. Inspections:

1. Provide independent third party inspection where required by code or contract documents.
2. Conduct inspections in accordance with code requirements and contract documents.

K. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area 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.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Protect coatings (pail products) from freezing and temperatures in excess of 90 degrees.

C. Protect Portland cement based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location.

1. Stack insulation board flat and off the ground.

1.13 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Do not install system when ambient outdoor temperatures 40°F (4°C) and falling unless temporary protection and heat provided to maintain ambient temperatures above 40°F (4°C) during installation of wet materials and for 24 hours after installation or longer to allow them to become thoroughly dry and weather resistant.
2. Provide supplementary heat for installation in temperatures less than 40 degrees F.
3. Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.14 SEQUENCING AND SCHEDULING

A. Sequence installation of system with related work specified in other sections to ensure that wall assemblies, including flashing, trim, and joint sealers, protected against damage from weather, aging, corrosion, or other causes.

B. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air barrier.

C. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

D. Coordinate installation of windows and doors so air barrier components are connected to them to provide a continuous air barrier.

E. Install window and door head flashing immediately after windows and doors are installed.

F. Install diverter flashing wherever water can enter the wall assembly to direct water to the exterior.

G. Install copings and sealant immediately after installation of the EIFS system and when EIFS coatings are dry.

H. Attach penetrations through EIFS to structural support and provide watertight seal at penetrations.

1.15 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.
b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:

a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
b. Insulation installed as part of EIFS including foam buildouts.
c. Insulation adhesive and mechanical fasteners.
d. EIFS accessories, including trim components and flashing.
e. Water-resistive barrier coatings.
f. EIFS drainage components.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide STO Corporation or a comparable product by one of the following:

1. Acrocrete; BASF Corp.

2. Dryvit Systems, Inc.
3. Parex USA, Inc.; Water Master Commercial DB.
4. Senergy Corp.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.2 MATERIALS

A. Compatibility: Provide adhesive, board insulation, reinforcing fabrics, base and finish coat materials, sealants, and accessories compatible with one another and approved for use by system manufacturer.

B. Provide colors and texture of protective coating to comply with following requirements:

1. Provide selection made by Architect from manufacturer's full range of standard colors and textures available for type of finish coat indicated.

2.3 SURFACE PREPARATION MATERIALS

A. Surface-Sealer: System manufacturer's standard adhesion intermediary designed to improve bond between substrate of type indicated and adhesive for application of insulation.

B. Conditioner: Water-based surface conditioner with a minimum solids content of 8% for treatment of dry, porous concrete, plaster or masonry surfaces, load bearing painted surfaces, or for protection of sheathing from moisture damage.

C. Leveler: Provide one of the following as required to level surfaces:

1. A one component factory proportioned enhanced 100% acrylic polymer based leveler for concrete, masonry, plaster/stucco surfaces and acrylic based textured coatings (for leveling up to 1/16").
2. A one component factory proportioned enhanced 100% acrylic polymer based leveler with water repellent additive for concrete, masonry or plaster surfaces (for leveling up to 1/8").
3. A one component factory proportioned polymer modified fiber reinforced cement based leveler with water repellent additive for concrete, masonry or plaster surfaces (for leveling up to 1/2").

D. Air/Moisture Barrier:

1. Joint Compound: Ready mixed acrylic based flexible joint compound for rough opening protection and joint treatment of wall sheathing.
2. Waterproof Coating: Ready mixed acrylic-based waterproof coating for wall sheathing.

2.4 ADHESIVE

A. Adhesive for Application of Insulation: System manufacturer's standard formulation designed for indicated use, compatible with substrate and complying with following requirements:

1. Cementitious Adhesives: Primer/Adhesive: One component polymer modified cement based, factory blend, and adhesive with less than 33 percent Portland cement content by weight (for use over exterior gypsum sheathing.
2. Factory-mixed formulation designed for adhesive attachment of insulation to substrates of type indicated, as approved by system manufacturer.
3. Either job-mixed or ready-mixed formulation indicated above.

2.5 RIGID BOARD INSULATION

A. General: Insulation to comply with requirements listed:

1. Insulation to be classified by Underwriter's Laboratory (U.L.).
2. Flame Spread: less than 25; Smoke Developed less than 450 in accordance with ASTM E 84.
3. Dimensional Tolerance: edges square within 1/16"; thickness uniform to within 1/16".
4. Minimum thickness of board 1"; maximum thickness of 4".

B. Nominal 1.0 lb/ft3 (16 kg/m3) Expanded Polystyrene (EPS) Insulation Board in compliance with ASTM C 578 Type I requirements, and EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board.

2.6 REINFORCING MESHES

A. Reinforcing Fabric: Balanced, alkali-resistant open weave glass fiber fabric treated for compatibility with other system materials; made from continuous multi-end strands with min. tensile strength of 120 lbs. and 140 lbs. in warp and fill directions, respectively, per ASTM D 1682 and complying with ASTM D 578 and following requirements:

B. Standard Mesh:

1. Nominal 4.5 oz./sq. Yd symmetrical, interlaced open-weave glass fiber fabric made with a min. 20 percent by weight alkaline resistant coating compatible with other system products.
2. Application: For application over Armor Mat.

C. Ultra-High Impact Mesh:

1. Armor Mat; Nominal 15 oz/yd2 (509 g/m^2), ultra-high impact, double strand, interwoven, open-weave glass fiber fabric with alkaline resistant coating compatible with other system materials.
2. Application; All Areas unless otherwise noted.

D. Specialty Meshes:

1. Corner Mat: Nominal 7.8 oz/yd^2 (265 g/m^2), pre-creased, heavy- duty, open-weave woven glass fiber fabric with alkaline resistant coating for compatible with other system components.
2. Application: Typical for all corners (inside and out).

2.7 EXTERIOR FINISH SYSTEM

A. Base Coat Materials; General: System manufacturer's standard, job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and system manufacturer's standard polymer-based adhesive designed for use indicated.

1. Formula to include integral water repellent.

B. Cementitious Base Coats: One component polymer modified cement based factory blend, base coat with less than 33 percent Portland cement content by weight.

C. Waterproof Base Coat: Two component fiber reinforced acrylic-based waterproof base coat mixed with Portland cement (for use as a waterproof base coat to waterproof foundations, parapets, splash areas, trim and other projecting architectural features).

D. Primer: Acrylic based tinted primer;

E. Finish Coat Materials: System manufacturer's standard mixture complying with following requirements for material composition and method of combining materials:

1. Factory-mixed formulation of acrylic based texture coating with graded marble aggregate, color-fast mineral pigments, fillers with integral waterproofing and mildew resistant additives.

2. Color and texture to be selected by Architect during shop drawing phase from manufacturers standard color and texture lines.

3. Texture: “Limestone” smooth StoLit 1.0 with free form

F. Color Selection: The lightness value of the exterior finish color to be applied over the insulation board shall be 20% or greater, and the color fastness shall not be less than 8.

2.8 ELASTOMERIC SEALANTS

A. Sealant Products: Provide manufacturer's standard chemically curing, elastomeric sealant compatible with joint fillers, joint substrates, and other related materials and complies with requirements of Division-7 section "Joint Sealers" for products corresponding to description indicated below.

1. Multi-Part Nonsag Urethane Sealant.
2. Sealant Color: Provide color of exposed sealants to comply with following requirements:

a. Provide color selected by Owner/Architect from manufacturer's standard colors.

2.9 MIXING

A. General: Comply with system manufacturer's requirements for combining and mixing materials.

1. Do not introduce admixtures, water, or other materials except as approved by system manufacturer.

2. Mix materials in clean containers.
3. Use materials within time period specified by system manufacturer or discard.

B. Mix with a clean, rust-free high-speed mixer to a uniform consistency.

C. Mix only as much material as can readily be used.

D. Do not use anti-freeze compounds or other additives.

2.10 WATER / CEMENT

A. Water: Clean and potable.

B. Cement: ASTM C 150-89 Portland Cement, Type I.

2.11 ACCESSORIES

A. High impact rigid PVC plastic, conforming to ASTM D-1784-81, Cell Classification 13244C, Manufactured with BF Goodrich Geon Vinyls.

1. Accessories include:

a. Starter track; Part No. STDE.
b. Corner Bead, 1-1/4" X 1-1/4" with perforated flanges.
c. "J" Bead, 1" back leg, 1/2" return.
d. "MJ" Bead, 1-1/8" perforated flange, 1/4" return.
e. Stop Beads, 1-1/8" perforated flange.
f. Channel Reveal, 3/4" wide unless noted.
g. Control Joint with removable tape, 3/16" reveal.
h. Expansion joint, with removable tape, 1/2" reveal.
i. Soffit Vent, 3" wide (unless noted), with a free area of 15 sq.in. per lineal foot.

B. Column Collar: Where Gypsum board abut round or partially round concrete columns provide preformed Column Trim of inside dimension to match column diameter.

1. Column Collar to be Single piece extruded aluminum of finish to match ceiling grid.
2. Size: Provide edge moldings fabricated to diameter required to fit penetration exactly.
3. Style: 3/4" Reveal Edge; of type to accommodate ceiling specified.
4. Approved Manufacturers; Subject to conformance with specification.

PART 3 - EXECUTION

3.1 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.2 GENERAL

A. Installation of EIFS system Components shall be performed by and/or supervised by Manufacturer trained Applicators only.

B. Under no circumstances shall any of the products be altered by adding any additives, except for small amounts of clean water as directed on label antifreeze, accelerators, rapid binders, etc., are forbidden.

C. Mix materials in accordance with manufacturers recommendations and instructions.

1. Mix with a clean, rust-free high speed mixer. Add water as directed on labeling.

3.3 INSTALLERS\APPLICATORS

A. Installer to meet criteria established above under the ‘Quality Assurance’ Section.

3.4 INSPECTION

A. Prior to application of finish system, representative of manufacturer of finish system shall examine substrate for compliance with Contract Documents and system manufacturer's specifications.

1. Advise Contractor and Architect of all discrepancies.

B. Contractor shall correct all noted deficiencies to the satisfaction of the Manufacturer and Architect.

1. Do not proceed with work until all unsatisfactory conditions corrected.

3.5 EXAMINATION

A. Examine substrates, with Installer present, to determine if in satisfactory condition for installation of system.

1. Do not proceed with installation of system until unsatisfactory conditions corrected.

B. Inspect sheathing application for compliance with applicable requirement:

1. Exterior gypsum sheathing – GA-253.
2. Glass mat faced gypsum sheathing – Georgia Pacific Publication 101514.
3. Cementitious sheathing – Consult manufacturer’s published recommendations.

C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the Air/Moisture Barrier and EIFS installation to the General Contractor. Do not start work until deviations are corrected.

3.6 PROTECTION

A. Protect contiguous work from moisture deterioration and soiling resulting from application of systems.

1. Provide temporary covering and other protection needed to prevent spattering of exterior finish coatings on other work.
2. Protect system, substrates, and wall construction behind them from inclement weather during installation.
3. Prevent infiltration of moisture behind system and deterioration of substrates.

B. Provide protection of installed materials from water infiltration into or behind them.

C. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry.

3.7 SURFACE PREPARATION

A. Substrate Preparation:

1. The surface to receive the EIFS shall be structurally sound, clean, dry and free of warpage, residual moisture or damage from moisture. Surfaces shall be uniform, with no irregularities greater than 1/8" in 4'-0".
2. Remove surface contaminants and replace damaged sheathing.
3. Spot surface defects in sheathing with joint compound.
4. Prepare and clean substrates to comply with system manufacturer's requirements to obtain optimum bond between substrate and adhesive for insulation.
5. Apply surface-sealer and/or conditioners over substrates where required by system manufacturer for improving adhesion.

3.8 INSTALLATION

A. Install Air/Moisture Barrier and EIFS in compliance with manufacturer’s published instructions.

B. Air/Moisture Barrier Installation:

1. For installation over glass mesh reinforced sheathing in compliance with ASTM C 1177:
2. Protect rough openings, joints and parapets: apply joint compound by trowel over rough openings sheathing joints, inside and outside corners, and tops of parapets. Immediately embed reinforcing mesh in the wet joint compound and trowel smooth. Embed minimum 4 inch wide mesh at sheathing joints and minimum 9 inch wide mesh at rough openings, inside and outside corners and tops of parapets.
3. Spot fasteners with joint compound.
4. Apply waterproof coating by roller over sheathing surface, including the dry joint compound, to a uniform wet mil thickness of 10 mils in one coat. Use 1/2 inch nap roller for plywood and gypsum sheathing. Use 3/4 inch nap roller for glass mat faced gypsum sheathing. Protect from weather until dry.
5. Coordinate installation of connecting air barrier components with other trades to provide a continuous airtight membrane.

6. Coordinate installation of flashing and other moisture protection components with other trades to achieve complete moisture protection such that water is directed to the exterior, not into the wall assembly, and drained to the exterior at sources of leaks (windows, doors and similar penetrations through the wall assembly).

C. Starter Track:

1. Strike a level line at the base of the wall to mark where the top of the starter track terminates.
2. Attach the starter track even with the line into the structure a maximum of 16 inches on center with the proper fastener: Type S-12 corrosion resistant screws for steel framing with minimum 3/8 inch penetration, and galvanized or zinc coated nails for wood framing with minimum 3/4 inch penetration. Attach between studs into sheathing as needed to secure the track flat against the wall surface. For solid sheathing attach directly into sheathing at 12 inches on center maximum.
3. Butt sections of starter track together. Miter cut outside corners and abut. Snip front flange of one inside corner piece (to allow EPS Board to be seated inside of track) and abut.
4. Install Starter Track at other EIF System terminations as designated on detail drawings: above windows and doors, at floor lines, above roof along dormers or gable end walls, and beneath window sills with concealed flashing.
5. Strike a level line at the base of the wall to mark where the top of the starter track terminates.
6. Attach the starter track even with the line into the structure a maximum of 16 inches on center with the proper fastener: Type S-12 corrosion resistant screws for steel framing with minimum 3/8 inch penetration, and galvanized or zinc coated nails for wood framing with minimum 3/4 inch penetration. Attach between studs into sheathing as needed to secure the track flat against the wall surface. For solid sheathing attach directly into sheathing at 12 inches on center maximum.
7. Butt sections of starter track together. Miter cut outside corners and abut. Snip front flange of one inside corner piece (to allow EPS Board to be seated inside of track) and abut.
8. Install Starter Track at other EIFS terminations as designated on detail drawings: above windows and doors, at floor lines, above roof along dormers or gable end walls, and beneath window sills with concealed flashing.

D. Splice Strips for Starter Track and Flashing:

1. Starter Track, Window/Door Head Flashing and Side Wall Step Flashing: install 2 inch wide diagonal splice strips of detail mesh at ends of head flashings. Install minimum 4-inch wide splice strips of detail mesh between back flange of starter track, head flashings and roof/side wall step flashing. Center the mesh so it spans evenly between the back flange of the Starter Track or flashing and the sheathing. Embed the mesh in the wet joint compound and trowel smooth.
2. Apply waterproof coating over the splice strip when the joint compound is dry

E. Backwrapping

1. Apply a strip of detail mesh to the dry air/moisture barrier at all system terminations (windows, doors, expansion joints, etc.) except where the Starter Track is installed. The mesh must be wide enough to adhere approximately 4 inches of mesh onto the wall, be able to wrap around the insulation board edge and cover a minimum of 2-1/2 inches on the

outside surface of the insulation board. Adhere mesh strips to the air/moisture barrier and allow them to dangle until the backwrap procedure is completed.

F. Adhesive Application and Installation of Insulation Board:

1. Rasp the lower face of insulation boards to provide a snug friction fit into the Starter Track. (Rasping prevents an outward bow at the Starter Track.
2. Apply adhesive to the back of the insulation board with the proper size stainless steel notched trowel. Apply uniform ribbons of adhesive parallel with the SHORT dimension of the board so that when boards are placed on the wall the ribbons will be VERTICAL.
3. Immediately place insulation boards in a running bond pattern on the wall with the long dimension horizontal. Start by inserting the lower edge of the boards inside the starter track at the base of the wall until they contact the bottom of the track. Apply firm pressure over the entire surface of the boards to ensure uniform contact of adhesive. Bridge sheathing joints by a minimum of 8 inches. Interlock inside and outside corners.
4. Butt all board joints tightly together to eliminate any thermal breaks in the EIFS. Care must be taken to prevent any adhesive from getting between the joints of the boards.
5. Cut insulation board in an L-Shaped patter n to fit around openings. Do not align board joints with corners of openings.
6. Remove individual boards periodically while the adhesive is still wet to check for satisfactory contact with the substrate and the back of the insulation board. An equal amount of adhesive must be on the substrate and the board when they are removed, as an indication of adequate adhesion. Do not use nails, screws, or any other type of non-thermal mechanical fastener.

G. Slivering and Rasping of Insulation Board Surface

H. EPS insulation board exposed to sunlight will develop a powdery residue on the surface. This reside must be entirely removed by rasping the surface.

I. After insulation boards are firmly adhered to the substrate, fill any open joints in the insulation board layer with slivers of insulation or approved spray foam.

1. Rasp the insulation board surface to achieve a smooth, even surface and to remove any ultraviolet ray damage.

J. Trim, Reveals and Projecting Aesthetic Features:

1. Attach features and trim where designated on drawings with adhesive to the insulation board or sheathing surface. Slope the top surface of all trim/features minimum 1:2 (27 degrees).
2. Cut reveals/aesthetic grooves with a hot-knife, router or groove-tool in locations indicated on drawings.
3. Offset reveals/aesthetic grooves minimum 3 inches (75 mm) from insulation board joints.
4. Do not locate reveals/aesthetic grooves at thigh stress areas such as corners of windows, doors, etc.
5. A minimum 3/4 inch (19 mm) thickness of insulation board must remain at the bottom of the reveals/aesthetic grooves.

K. Completion of Backwrapping:

1. Complete the backwrapping procedure by applying base coat to exposed edges of insulation board and approximately 4 inches (100 mm) onto the face to the insulation board. Pull mesh tight around the board and embed it in the base coat with a stainless steel trowel. Use a corner trowel for clean, straight lines. Smooth any wrinkles of gaps in the mesh.

L. Base Coat and Reinforcing Mesh Application:

1. Apply minimum 9x12 inch diagonal strips of detail mesh at corners of windows, doors, and all penetrations through the system. Embed the strips in wet base coat and trowel from the center to the edges of the mesh to avoid wrinkles.
2. Apply detail mesh at trim, reveals and projecting architectural features. Embed the mesh in the wet base coat. Trowel from the base of reveals to the edges of the mesh.
3. Ultra-High Impact mesh application: Apply base coat over the insulation board with spray equipment or a stainless steel trowel to a uniform thickness of approximately 1/8 inch. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Butt the mesh at scams. Allow the base coat to dry.
4. Standard mesh application: Apply base coat over the insulation board and Ultra-High impact mesh, with spray equipment or a stainless steel trowel to a uniform thickness of approximately 1/8 inch. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2-1/2 inches at mesh seams and at overlaps of detail mesh. Feather seams and edges. Double wrap all inside and outside corners with minimum 2-1/2 inch (64 mm) overlap in each direction. Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re-skim with additional base coat if mesh color is visible.
5. Sloped Surfaces: for trim, reveals, aesthetic bands, cornice profiles, sills or other architectural features that project beyond the vertical wall plane more than 2 inches apply waterproof base coat with a stainless steel trowel to the weather exposed sloped surface and minimum four inches above and below it. Embed standard mesh or detail mesh in the waterproof base coat and overlap mesh scams a minimum of 2-1/2 inches.
6. Allow base coat to thoroughly dry before applying primer or finish.

M. Primer Application:

1. Apply primer evenly with brush, roller or proper spray equipment over the clean, dry base coat and allow to dry thoroughly before applying finish.

N. Finish Coat Application: Apply finish directly over the base coat (or primed base coat) when dry. Apply finish by spraying or troweling with stainless steel trowel, depending on the finish specified. Follow these general rules for application of finish:

1. Avoid application in direct sunlight.
2. Apply finish in a continuous application, and work to an architectural break in the wall.
3. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results: cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
4. Float “R” (rilled texture) finishes with a plastic trowel to achieve their rilled texture
5. Do not install separate batches of finish side-by-side.

6. Do not apply finish into or over sealant joints. Apply finish to outside face of wall only.
7. Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the requirements of the project specifications.
8. All EIFS is to receive limestone finish. First finish coat STO LIT 1.0. Second finish coat ‘Free Form”. Texture must be smooth.

3.9 JOINTS

A. Provide minimum 3/4 inch wide expansion joints in the EIFS where they exist in the substrate or supporting construction, where the EIFS adjoins dissimilar construction or materials, at changes in building height, and at floor lines in multi-level wood frame construction.

B. Provide minimum 1/2 inch (13 mm) wide sealant joints at all penetrations through the EIFS (windows, doors, etc.).

C. Provide compatible backer rod and sealant that has been evaluated in accordance with ASTM C1382, “Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish System (EIFS) Joints,” and that meets minimum 50% elongation after conditioning.

D. Provide joints so that air barrier continuity is maintained across the joint and drain joints to the exterior.

3.10 TRIM, PROJECTING ARCHITECTURAL FEATURES AND REVEALS:

A. All trim and projecting architectural features shall have a minimum 1:2 (27 degrees) slope along their top surface.

B. All horizontal reveals shall have a minimum 1:2 (27 degrees) slope along their bottom surface.

C. Where trim/feature or bottom surface of reveal projects more than 2 inches from the face of the EIFS wall plane, protect he top surface with waterproof base coat.

3.11 ACCESSORIES

A. Install rigid vinyl accessories as shown on Architect's Details or as required to complete installation of finish system.

1. Install 3" soffit vent around perimeter (4 sides) of each exterior soffit or ceiling.
2. Install expansion and control joints as recommended by manufacturer and as described above.

B. Install accessories in full compliance with manufacturer's written recommendations.

1. Accessories shall be mechanically fastened to substrate using nails or screws spaced at no more than 12" on center.
2. Install accessories straight, square and true.
3. Face of accessory to be flush with surface of finish system.

3.12 INSTALLATION OF JOINT SEALANTS

A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements of Division-7 section "Joint Sealers".

3.13 ACCEPTANCE

A. The finished surface shall be of uniform thickness, texture, color appearance and free of irregularities.

1. Surface to be plumb to within 1/16" in 4'-0".
2. Surface to be level to within 1/16" in 4'-0".

B. The finish shall be uniform in color, free from bleed thru of base course or mesh.

C. EFIS and insulation system to be free from cracks and other surface imperfections.

3.14 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work.

1. Promptly remove protective coatings from window and door frames, and any other surfaces outside areas indicated to receive protective coating.

B. Provide final protection and maintain conditions, in manner acceptable to Installer and system manufacturer, which ensures system being without damage or deterioration at time of Final Acceptance.

END OF SECTION 07 2419

SECTION 07 3113 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber-reinforced asphalt shingles.
2. Underlayment materials.
3. Ridge vents.
4. Metal flashing and trim.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Asphalt shingles.
2. Underlayment materials.
3. Ridge vents.
4. Asphalt roofing cement.
5. Elastomeric flashing sealant.

B. Shop Drawings: For metal flashing and trim.

C. Samples: For each exposed product and for each color and blend specified, in sizes indicated.

1. Asphalt Shingles: Full size.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by a qualified testing agency.

C. Research Reports: For synthetic underlayment, from ICC-ES, indicating that product is suitable for intended use under applicable building codes.

D. Sample Warranty: For manufacturer's materials warranty.

1.7 CLOSEOUT SUBMITTALS

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

B. Materials warranties.

C. Roofing Installer's warranty.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft. of each type and in each color and blend, in unbroken bundles.

1.9 QUALITY ASSURANCE

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

B. Perform Work in accordance with the recommendations of NRCA Steep Roofing Manual.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.

B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.

C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.

D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.

1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.12 WARRANTY

A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Manufacturing defects.

2. Materials Warranty Period: 40 years from date of Substantial Completion, prorated, with first 15 years nonprorated.
3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 100 mph for five years from date of Substantial Completion.
4. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 20 years from date of Substantial Completion.
5. Workmanship Warranty Period: 20 years from date of Substantial Completion.

B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt shingle roofing 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 SOURCE LIMITATIONS

A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.

2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Certainteed, SAINT-GOBAIN; Landmark Premium Shingles.
    b. GAF; Natural Shadow Architectural.
    c. Owens Corning; Oakridge Architectural.
    d. Tamko Building Products LLC; Heritage Architectural.

2. Butt Edge: Manufacturer's standard.
3. Strip Size: Manufacturer's standard.
4. Algae Resistance: Granules resist algae discoloration.
5. Color and Blends: As selected by Architect from manufacturer's full range.

B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 40-mil-thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
    b. Certainteed, SAINT-GOBAIN; Winterguard.
    c. GAF; Weatherwatch.
    d. GCP Applied Technologies Inc.; Grace Ice & Water Shield HT.
    e. Henry Company.
    f. Owens Corning; WeatherLock.
    g. Tamko Building Products LLC; Moisture Guard Plus.

2. Provide high temperature self-adhered roofing underlayment.

2.5 RIDGE VENTS

A. Rigid Ridge Vent: Manufacturer's standard, rigid-section, high-density, UV-stabilized plastic ridge vent for use under ridge shingles.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Air Vent, Inc.; Gibraltar Industries, Inc.
    b. Benjamin Obdyke Incorporated.
    c. Certainteed; SAINT-GOBAIN.
    d. Cor-A-Vent, Inc.
    e. GAF.
    f. Lomanco, Inc.

g. Owens Corning.
h. Tamko Building Products LLC.
i. Tapco International Corporation; Mid-America Components.

2. Minimum Net Free Area: Provide enough vents to comply with Attic Ventilation Code
3. requirements acceptable to Authorities and agencies having jurisdiction.

2.6 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.

B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.

C. Roofing Nails: ASTM F1667, aluminum, stainless steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, sharp-pointed, with a 3/8- to 7/16-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through sheathing less than 3/4 inch thick.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

D. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch-minimum diameter.

1. Provide with minimum 0.0134-inch-thick metal cap, 0.010-inch-thick power-driven metal cap, or 0.035-inch-thick plastic cap; and with minimum 0.083-inch-thick ring shank or 0.091-inch-thick smooth shank of length to penetrate at least 3/4 inch into roof sheathing or to penetrate through roof sheathing less than 3/4 inch thick.

2.7 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 07 6200 "Sheet Metal Flashing and Trim."

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.

1. Drip Edges: Fabricate in lengths not exceeding 10 feet with minimum 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
2. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through asphalt shingles.
3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

A. Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.

B. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck.

1. Comply with low-temperature installation restrictions of underlayment manufacturer.
2. Install lapped in direction that sheds water.

    a. Lap sides not less than 4 inches.
    b. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
    c. Roll laps with roller.

3. Cover underlayment within seven days.

3.3 INSTALLATION OF METAL FLASHING AND TRIM

A. Install metal flashings and trim in accordance with manufacturer’s instructions and SMACNA Architectural Sheet Metal Manual requirements.

1. Install metal flashings in accordance with recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
2. Bed flanges of metal flashings using asphalt roofing cement or elastomeric flashing sealant.

B. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.

C. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.

D. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 INSTALLATION OF ASPHALT SHINGLES

A. Install asphalt shingles in accordance with manufacturer's written instructions and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of laminated asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install first and remaining courses of three-tab-strip asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

E. Fasten asphalt shingle strips with a minimum of four roofing nails, but not less than the number indicated in manufacturer's written instructions for roof slope and design wind speed indicated on Drawings and for warranty requirements specified in this Section.

1. Locate fasteners in accordance with manufacturer's written instructions.
2. Where roof slope exceeds 18:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
3. Where roof slope is less than 4:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
4. When ambient temperature during installation is below 50 deg F, hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.

F. Ridge Vents: Install continuous ridge vents over asphalt shingles in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

G. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing-shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.

1. Fasten with roofing nails of sufficient length to penetrate sheathing.
2. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.5 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("the work") on the following project:

1. Owner:
2. Owner Address:
3. Building Name/Type:
4. Building Address:
5. Area of the Work:
6. Acceptance Date:
7. Warranty Period:
8. Expiration Date:

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant the work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that, during Warranty Period, Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of the work as are necessary to correct faulty and defective work and as are necessary to maintain the work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to the work and other parts of the building, and to building contents, caused by:

    a. Lightning;
    b. Peak gust wind speed exceeding 100 mph;
    c. Fire;
    d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. Faulty construction of copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. Vapor condensation on bottom of roofing; and
    g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When the work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to the work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the work.
4. During Warranty Period, if Owner allows alteration of the work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of the alterations, but only to the extent the alterations

affect the work covered by this Warranty. If Owner engages Roofing Installer to perform the alterations, Warranty shall not become null and void unless Roofing Installer, before starting the alterations, notified Owner in writing, showing reasonable cause for claim, that the alterations would likely damage or deteriorate the work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty shall become null and void on date of the change, but only to the extent the change affects the work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect the work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on the work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of the work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

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

1. Authorized Signature:
2. Name:
3. Title:

END OF SECTION 07 3113

SECTION 07 4646 - FIBER-CEMENT SIDING

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 fiber-cement siding.

1.3 COORDINATION

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

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

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

B. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch-long-by-actual-width Sample of siding.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement siding.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of fiber-cement siding including related accessories, in a quantity equal to 2 percent of amount installed.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 3 years of experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Building Products, Inc.; Plank Lap Siding or a comparable product by one of the following:

a. American Fiber Cement Corporation.
b. CertainTeed; SAINT-GOBAIN.
c. GAF.
d. Nichiha USA, Inc.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Horizontal Pattern: Boards 5-1/4 inches wide in plain style.

1. Texture: Smooth.

E. Factory Priming: Manufacturer's standard acrylic primer.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Flashing: Provide aluminum flashing complying with Section 07 6200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

C. Fasteners:

1. For fastening to wood, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
3. For fastening fiber cement, use stainless-steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.

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

3.2 PREPARATION

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

3.3 INSTALLATION

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

1. Do not install damaged components.
2. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 07 9200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 4646

SECTION 07 4646.13 - FIBER-CEMENT 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 fiber-cement panels.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

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

B. Samples for Verification: For each type, color, texture, and pattern required.

1. 24-inch-wide-by-36-inch-high Sample panel of panels assembled on plywood backing.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement panels.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement panels.

C. Research/Evaluation Reports: For each type of fiber-cement panel required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of fiber-cement panels including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 3 years of experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.10 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.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT PANELS

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Building Products, Inc.; Vertical Siding, HardiePanel HZ10 or comparable product by one of the following:

a. American Fiber Cement Corporation.
b. Certainteed; SAINT-GOBAIN.
c. GAF.
d. Nichiha USA, Inc.

B. Labeling: Provide fiber-cement panels that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Panel Texture: 48-inch-wide sheets with smooth texture.

E. Factory Priming: Manufacturer's standard acrylic primer.

2.3 ACCESSORIES

A. Panel Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by panels manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent panels unless otherwise indicated.

B. Flashing: Provide aluminum flashing complying with Section 07 6200 "Sheet Metal Flashing and Trim" where indicated.

C. Fasteners:

1. For fastening to wood, use panels nails of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
3. For fastening fiber cement, use stainless-steel fasteners.
4. Fasteners shall be of high quality stainless steel to ensure resistance to corrosion. For field painting, fasteners shall be treated to accept paint adhesion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement panels and related accessories.

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

3.2 PREPARATION

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

3.3 INSTALLATION

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

1. Do not install damaged components.
2. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 07 9200 "Joint Sealants" and to produce a weathertight installation.

C. Painting as specified in Section 09 9000 “Paints and Coatings.”

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 4646.13

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fabricated sheet metal items, including flashings.
2. Sill flashing.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Manufactured products. Include material descriptions, standard details, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.6 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation.

1. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL FLASHING AND TRIM MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Thickness: 0.032 inch thick (20 gage) except as otherwise indicated.
2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Extruded Aluminum: Manufacturer's standard extrusions of sizes and profiles indicated, 60063-T52, AA-C22A41 clear anodized finish; 0.080" min. thickness for primary legs of extrusions.

D. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

E. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat.

2.3 SILL FLASHING

A. Membrane Flashing: Flexible flashing for use as concealed flashing at window sills at exterior masonry walls. ASTM D-822, ASTM D-41R, 30 gage, size required for min. joints.

B. Installation: Except as otherwise indicated, comply with manufacturer's installation instructions.

C. Joints: Except as otherwise indicated, laps and cements per manufacturer's installation instructions.

D. Materials: AFCO V1-Seal plastic flashing or approved equal.

2.4 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer; match finish of exposed heads with material being fastened.

B. Elastomeric Sealant for Concealed Locations: ASTM C 920, silicone sealant of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

C. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

D. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with min. stress on flashing sheet.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
5. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 INSTALLATION REQUIREMENTS

A. General:

1. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual".
2. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level indicated.
3. Install work with laps, joints and seams permanently watertight and weatherproof.

3.3 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.5 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 6200

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Heat and smoke vents.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
2. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

A. Provide manufacturer's standard 5 year warranty. Roof smoke vents shall be free from manufacturing defects in materials and fabrication for a period of 5 years from the date of substantial Completion. Should a product fail to function in normal use within this period, manufacturer shall furnish a replacement or new parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 HEAT AND SMOKE VENTS

A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard, with double-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 165 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. BILCO Company (The).
d. JL Industries, Inc.; a division of the Activar Construction Products Group.
e. Kingspan Light + Air, North America.
f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
g. Nystrom, Inc.
h. O'Keeffe's Inc.

2. Type and Size: Double-leaf lid, 60 by 96 inches.
3. Loads: Minimum 40-lbf/sq. ft. external live load and 30-lbf/sq. ft. internal uplift load.

    a. When release is actuated, lid shall open against 10-lbf/sq. ft. snow or wind load and lock in position.

4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793.

5. Curb, Framing, and Lid Material: Aluminum sheet.

    a. Thickness: Manufacturer's standard thickness for hatch size indicated.
    b. Finish: Mill.

6. Construction:

    a. Insulation: 2-inch-thick, polyisocyanurate board.

        1) R-Value: 12.0 according to ASTM C1363.

    b. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
    c. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
    d. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
    e. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
    f. Security Grille: Provide for all units.

7. Hardware: Manufacturer's standard corrosion resistant; with hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.
8. Manual Winch: Operation allowing remote closing of smoke vent from the floor area.
9. Vent covers open with external manual pull handle, 1/16" dia. SST cable and vent covers open and close with manual winch, 100ft 1/8" dia. cable.

2.3 METAL MATERIALS

A. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

    1. Mill Finish: As manufactured.

B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Security Grilles: 3/4-inch diameter, ASTM A1011/A1011M steel bars spaced 6 inches o.c. in one direction and 6 inches o.c. in the other; factory finished as follows:

1. Surface Preparation: Remove mill scale and rust, if any, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Underlayment:

1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

I. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

J. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

K. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 GENERAL FINISH REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.

2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

D. Security Grilles: Weld bar intersections and, using tamper-resistant bolts, attach the ends of bars to structural frame or primary curb walls.

E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7200

SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Penetration firestopping systems for the following applications:

a. Penetrations in fire-resistance-rated walls.
b. Penetrations in horizontal assemblies.
c. Penetrations in smoke barriers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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

1.6 CLOSEOUT SUBMITTALS

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

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

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

    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

        1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. Hilti, Inc.
d. Specified Technologies, Inc.
e. Tremco, Inc.
f. USG Corporation.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration

firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Refer to Drawings for Basis of Design Fire Stopping Designs and design numbers.

END OF SECTION 07 8413

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Extent of each form and type of joint sealer indicated on Drawings and Schedules.

B. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

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

B. Samples for Verification: For each kind 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. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Field-Adhesion Test Reports: For each sealant application tested.

D. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Installer successfully completed within last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.

B. Evaluation of Field Test Results:

1. Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, considered satisfactory.
2. Do not use sealants which fail to adhere to joint substrates during testing.

C. Field-Constructed Mock-Ups: Prior to installation of joint sealers, apply elastomeric sealants to following selected building joints indicated below for further verification of colors selected from sample submittals and to represent completed work for qualities of appearance, materials and application:

1. Joints in field-constructed mock-ups of assemblies specified in other sections indicated to receive elastomeric joint sealants in this Section.
2. Retain mock-ups during construction as standard for judging completed construction.

D. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

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

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealers to occur min. 21 nor max. 30 days after completion of waterproofing, unless otherwise indicated.

1.10 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

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

B. Stain-Test-Response Characteristics: Where 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

D. Formulate sealant for interior joints to accept paint after curing.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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; 790 NS Parking Structure Sealant.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. May National Associates, Inc.; Bondaflex Sil 290; Bondaflex Sil 728 NS.
d. Pecora Corporation; 301 NS; 311 NS; 890; 890FTS.
e. Sika Corporation, Construction Products Division; SikaSil-C990.
f. Tremco Incorporated; Spectrem 1; Spectrem 800.

B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

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. BASF Building Systems; Omniseal 50.
b. Dow Corning Corporation; 756 SMS; 791; 795; 995.
c. GE Advanced Materials - Silicones; SilGlaze II SCS2800; SilPruf NB SCS9000; SilPruf SCS2000; UltraPruf II SCS2900.
d. May National Associates, Inc.; Bondaflex Sil 295.
e. Pecora Corporation; 864; 895; 898.
f. Polymeric Systems, Inc.; PSI-641.
g. Sika Corporation, Construction Products Division; SikaSil-C995.
h. Tremco Incorporated; Spectrem 2; Spectrem 3.

C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

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; 799.
b. GE Advanced Materials - Silicones; UltraGlaze SSG4000; UltraGlaze SSG4000AC.
c. May National Associates, Inc.; Bondaflex Sil 200 GPN; Bondaflex Sil 201 FC.
d. Polymeric Systems, Inc.; PSI-631.
e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
f. Tremco Incorporated; Proglaze SSG; Tremsil 600.

D. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.

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. Tremco Incorporated; Spectrem 4TS.

E. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; 898.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
b. Tremco Incorporated; Vulkem 921; Dymonic FC.
c. Sherwin-Williams LOXON H1 Polyurethane Sealant.

B. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

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. Pacific Polymers International, Inc.; Elasto-Thane 230 LM Type II.
b. Polymeric Systems, Inc.; PSI-901.
c. Sherwin-Williams LOXON H1 Polyurethane Sealant.

C. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

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. BASF Building Systems; Sonolastic NP1; Sonalastic TX1; Sonolastic Ultra.
b. Bostik, Inc.; Chem-Calk 900; 915; 916 Textured.
c. May National Associates, Inc.; Bondaflex PUR 25; Bondaflex PUR 25 Textured; Bondaflex PUR 40 FC.
d. Pacific Polymers International, Inc.; Elasto-Thane 230 Type II.
e. Pecora Corporation; Dynatrol I-XL.
f. Polymeric Systems, Inc.; Flexiprene 1000.
g. Sherwin-Williams LOXON TX Polyurethane Sealant.
h. Sherwin-Williams LOXON S1 Polyurethane Sealant.
i. Schnee-Morehead, Inc.; Permathane SM7100; Permathane SM7108; Permathane SM7110.
j. Sika Corporation, Construction Products Division; Sikaflex - 1a.

k. Tremco Incorporated; Dymonic; Vulkem 116.

D. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; Dynatrol II.
b. Polymeric Systems, Inc.; PSI-270.
c. Tremco Incorporated; Dymeric 240; Dymeric 240 FC.
d. Sherwin-Williams LOXON NS2 Polyurethane Sealant.

E. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.

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. BASF Building Systems; Sonolastic NP 2.
b. Bostik, Inc.; Chem-Calk 500.
c. May National Associates, Inc.; Bondaflex PUR 2 NS.
d. Pacific Polymers International, Inc.; Elasto-Thane 227 High Shore Type II; Elasto-Thane 227 R Type II; Elasto-Thane 227 Type II.
e. Pecora Corporation; Dynatred.
f. Sika Corporation, Construction Products Division; Sikaflex - 2c NS; Sikaflex - 2c EZ Mix.
g. Tremco Incorporated; Vulkem 227.
h. Sherwin-Williams LOXON NS2 Polyurethane Sealant.

F. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.

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. Polymeric Systems, Inc.; PSI-270.
b. Tremco Incorporated; Dymeric 240 FC.
c. Sherwin-Williams LOXON NS2 Polyurethane Sealant.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.

c. May National Associates, Inc.; Bondaflex 600; Bondaflex Sil-A 700.
d. Pecora Corporation; AC-20+.
e. Schnee-Morehead, Inc.; SM 8200.
f. Tremco Incorporated; Tremflex 834.
g. Sherwin-Williams Powerhouse 1100A Siliconized Acrylic Latex Sealant.

2.5 MISCELLANEOUS JOINT SEALANTS

A. Butyl-Polyisobutylene Sealant: Manufacturer's standard, solvent-release- curing, butyl-polyisobutylene sealant complying with AAMA 809.2, recommended for concealed joints.

B. Butyl-Polyisobutylene Tape Sealant: Manufacturer's standard, solvent free, butyl-polyisobutylene tape sealant with solids content of 100% complying with AAMA 804.1; formulated nonstaining, paintable, and nonmigrating in contact with nonporous surfaces; packaged on rolls with release paper on one side; with or without reinforcement thread to prevent stretch.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Butyl-Polyisobutylene Sealant and Butyl-Polyisobutylene Tape Sealant:

a. "PTI 404"; Protective Treatments, Inc.
b. "Extru-Seal Tape"; Pecora Corp.
c. "Shim-Seal Tape"; Pecora Corp.
d. "PTI 606;" Protective Treatments, Inc.
e. "Tremco 440 Tape"; Tremco Inc.

2.6 JOINT SEALANT BACKING

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

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nongassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Either open cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.

D. Elastomeric Tubing Joint-Fillers:

1. Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to -26ºF (-15ºC).
2. Provide products with low compression set and of size and shape to provide secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

E. 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. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

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

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Accessory materials for Fire-Stopping Sealants: Provide forming, joint- fillers, packing and other accessory materials required for installation of fire-stopping sealants as applicable to installation conditions indicated.

2.8 JOINT FILLERS FOR CONCRETE PAVING

A. General: Provide joint fillers of thickness and widths indicated.

B. Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D 1751:

1. Asphalt saturated fiberboard, 1/2" thick unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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 or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

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

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

C. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

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

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

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

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

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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 profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

H. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

I. Installation of Fire-Stopping Sealant:

1. Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs.
2. Comply with installation requirements established by testing and inspecting agency.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

A. Extent of each form and type of joint sealer indicated on Drawings and Schedules.

B. Section includes joint sealers for following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces, elastomeric joint sealant, use NT, as indicated below:

    a. Control and expansion joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Extend Sealants; under flashing and top of brick all Brick Control Joints.
    d. Joints between different materials listed above.
    e. Perimeter joints between materials listed above and frames of doors and windows.
    f. Control and expansion joints in ceiling and overhead surfaces.
    g. Other joints as indicated.

2. Exterior joints in horizontal traffic surfaces, elastomeric joint sealant, use T as indicated below:

    a. Control, expansion, and isolation joints in cast-in-place concrete slabs for floors and paving.
    b. Joints between architectural precast concrete paving units.
    c. Joints in stone paving units, including steps.
    d. Tile control and expansion joints.
    e. Joints between different materials listed above.
    f. Other joints as indicated.

3. Interior joints, 3/8" or less in width, in vertical surfaces and horizontal nontraffic surfaces, solvent-release-curing joint sealants as indicated below:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
    d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    e. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    f. Perimeter joints of toilet fixtures.
    g. Other joints as indicated.

4. Interior joints, greater than 3/8" in width, in vertical surfaces and horizontal nontraffic surfaces, elastomeric joint sealant, use NT, as indicated below:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
    c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    d. Joints on underside of precast beams and planks.
    e. Other joints as indicated

5. Interior joints in horizontal traffic surfaces elastomeric joint sealant, use T as indicated below:

    a. Control and expansion joints in cast-in-place concrete slabs.
    b. Other joints as indicated.

6. Other interior joints, miscellaneous sealants, as indicated below:

    a. Sight exposed locations, to provide finished appearance, where not specified above.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

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

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.

7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assembly and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

D. Field quality control reports.

1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

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

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard Kraft-paper honeycomb Polystyrene.
f. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
f. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
g. Core: Manufacturer's standard Polystyrene Polyurethane.
h. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.8 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 08 8000 "Glazing."

2.9 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite 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 welding, or by rigid mechanical anchors.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.10 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.11 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

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

B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.5 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

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

END OF SECTION 08 1113

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 08 8000 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. For each type of door indicated.
2. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

B. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Graham Wood Doors.
    b. Lambton Doors.
    c. Masonite Architectural.
    d. Oshkosh Door Company.
    e. VT Industries Inc.

2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
3. Architectural Woodwork Standards Grade: Custom.
4. Faces: Single-plywood veneer not less than 1/50 inch thick.

    a. Species: As selected by Architect from manufacturer's full range.
    b. Cut: Plain sliced (flat sliced).
    c. Match between Veneer Leaves: Book match.
    d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
    e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
    f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.

5. Exposed Vertical and Top Edges: Same species as faces - Architectural Woodwork Standards edge Type A.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.

        1) Finish steel edges and astragals with baked enamel same color as doors.

    d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors:

a. ANSI A208.1, Grade LD-2 particleboard.
b. WDMA I.S. 10 structural composite lumber.

1) Screw Withdrawal, Door Face: 550 lbf.
2) Screw Withdrawal, Vertical Door Edge: 550 lbf.

7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

C. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.

1. Wood Species: Same species as door faces.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.

B. Factory finish doors.

1. Stain color Match Architects sample.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Custom.
2. Finish: ANSI/WDMA I.S. 1A TR-8 UV Cured Acrylated Polyester/Urethane
3. Staining: Refer to Finish Schedule on Drawings.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 7100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Provide inspection of installed Work through WI's Certified Compliance Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 08 7100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.

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. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION 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. 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.

1.5 INFORMATIONAL SUBMITTALS

A. 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.

B. 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 Procedures.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.6 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. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. 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.

D. 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.

E. 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.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. 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.

H. 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

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.7 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".

1.8 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 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.

1.9 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. Five years for standard duty cylindrical (bored) locks and latches.
2. Five years for exit hardware.
3. Two years for electromechanical door hardware, unless noted otherwise.

1.10 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.

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 and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

   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: With the exception of electric through wire hinges, 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. Manufacturers:

   a. Hager Companies (HA).
   b. McKinney (MK).
   c. Stanley Hardware (ST).

2.3 DOOR OPERATING TRIM

A. 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. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
3. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood (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.

1. Manufacturers:

    a. Corbin Russwin (RU).
    b. Dormakaba Best (BE).
    c. Yale Commercial (YA).

C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. 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.
6. Keyway: Manufacturer’s Standard.

D. Interchangeable Cores: Provide small format interchangeable cores as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "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. Existing System: Field verify and key cylinders to match Owner's existing system.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
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).

G. Construction Keying: Provide temporary keyed construction cores.

H. 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.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.

1. Locks are to be non-handed and fully field reversible.
2. Manufacturers:

a. Corbin Russwin (RU) - CLX3300 Series.
b. Dormakaba (DO) - CL800 Series.
c. Yale Commercial(YA) 4700LN 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 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.
11. Hurricane and Tornado Resistance Compliance: Conventional exit devices are to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

    a. Corbin Russwin (RU) – ED5000 Series.
    b. Dormakaba Precision (PR) - Apex 2000 Series.
    c. Yale (YA) - 7000 Series.

2.8 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.
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. 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 Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. 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 Certified Products Directory (CPD) listed 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. Manufacturers:

    a. Corbin Russwin (RU) - DC6000 Series.
    b. Norton Rixson (NO) - 7500 Series.
    c. Yale Commercial(YA) - 4400 Series.

C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:

    a. Corbin Russwin (RU) – Unitrol Series.
    b. Norton Rixson (NO) - Unitrol Series.
    c. Yale Commercial(YA) - Unitrol Series.

2.9 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

a. LCN - SEM7800 Series.
b. Norton Rixson (RF) - 980/990 Series.
c. Sargent Manufacturing (SA) - 1560 Series.

2.10 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood (RO).
    c. Trimco (TC).

2.11 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. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed 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. Manufacturers:

a. Dormakaba (DO).
b. Norton Rixson (RF).
c. Sargent Manufacturing (SA).

2.12 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.

1. Manufacturers:

a. National Guard Products (NG).
b. Pemko (PE).
c. Reese Enterprises, Inc. (RE).

2.13 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.

2.14 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. DHI TDH-007-20: Installation Guide for Doors and Hardware.
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 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.

3.5 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.

3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 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.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Information:

Manufacturer's Abbreviations	
Code	**Name**
AB	ABH Manufacturing Inc.
BE	Best Access Systems
DM	Dorma Door Controls
NA	National Guard
SH	dormakaba Commercial Hardware
ST	BEST Hinges and Sliding
TR	Trimco
BY	By Other Trades-Contractor to coordinate.

Finish List	
Code Description	
26D	Satin Chrome
32D	Satin Stainless Steel
600	Primed for Painting
626	Satin Chromium Plated
630	Satin Stainless Steel
689	Aluminum Painted
AL	Aluminum
GREY	Grey
US32D	Stainless Steel, Dull
Option List	
Code	Description
1" EXTENSION	1" Extension For Wall Magnets
1/4-20 MS/EA	1/4-20 Machine Screw/Expansion Anchor
14 X 1 1/2" SSWS	14 X 1 1/2" Stainless Wood Screw
3/4" EXTENSION	3/4" Extension For Wall Magnets
7FT	TOP ROD For 7' Door
B4E-HEAVY-KP	Beveled 4 Edges - Kick Plates
CD	Cylinder Dogging
CSK	Counter Sinking Of Kick And Mop Plates
F	Full Size Cover
L	Less Cylinder (Sgl)
LB	Less Bottom Rod
LB	Less Bottom Rod (Labelled Devices)
Less Cylinder	Less Cylinder
PA	Plastic Anchors
R	Full Size Rounded Plastic Cover
R705	Straight Cylinder Ring - 5/16"

S/TAP	Self Tapping Screws (8)
S3	Ansi Strike Package
SMS-TEKS 6 X 1"	Self Drilling Screws 6 X 1"
SN	Sex Nuts
SNB	Sex Nuts
STAINLESS SPANNER HEAD SMS 10 X 1 1/2"	Spanner Head Screws 10 X 1 1/2"

3.8 HARDWARE SETS

HW-1 MAIN ENTRY DOOR (PR)				
2	Continuous Hinge	661HD UL 90 1/2"	AL	ST
1	Removable Mullion	1340 KR-8 Less Cylinder	600	DM
2	Rim Exit Device	9300C CD L SNB	630	DM
1	Exit device Pull trim	YP02 L	630	DM
1	Exit Device Pull trim	YP03 L	626	DM
3	Mortise Cylinder	1E-74 PATD-Cam as req.	626	BE
1	Rim Cylinder	12E-72 PATD R705	626	BE
2	Door Closer	QDC119 R S/TAP SN	689	SH
2	HD Ext Floor Stop	1209HA	630	TR
1	Gasketing Set- Pair	137 SA SET 1 x 72" 2 x 84" SMS 10 X 1 1/2"		NA
1	Meeting Astragal SET	137 SA SET 84" SMS-TEKS 6 X 1"		NA
2	Door Sweep	200 SA 36" SMS-TEKS 6 X 1"		NA
1	Saddle Threshold	425 72" 1/4-20 MS/EA	AL	NA
2	Conc. Dr Contacts	By Alarm Supplier		BY

HW-2 RISER ROOM EXT				
3	Hinges	FBB199 4.5" x 4.5" NRP	32D	ST
1	Storeroom Lockset	9K3-7D14D PATD S3	626	BE
1	Door Closer	QDC119 R S/TAP SN	689	SH
1	HD Ext Floor Stop	1209HA	630	TR
1	Lock Astragal	5001	630	TR
1	Gasketing Set	137 SA SET 1 x 36" 2 x 87" SMS-TEKS 6 X 1"		NA
1	Drip Cap	16 A FATT 40" SMS-TEKS 6 X 1"		NA
1	Door Sweep	200 SA 36" SMS-TEKS 6 X 1"		NA
1	Saddle Threshold	425 36" 1/4-20 MS/EA PA	AL	NA
1	Conc. Dr Contacts	By Alarm Supplier		BY

HW-3 STAIR EXIT DOORS - UL				
2	Continuous Hinge	661 HD 84"	AL	ST
1	Removable Mullion	F1340 KR-8 Less Cylinder	600	DM
2	F Rim Exit Device	F9300C L	630	DM
2	Exit Device Trim	YC08 L	630	DM
1	Mortise Cylinder	1E-74 PATD-Cam as req.	626	BE
2	Rim Cylinder	12E-72 PATD R705	626	BE
2	Kickplate Pair	K0050 8" x 1" LDW B4E CSK	630	TR
2	Dome Stop	1211	626	TR
1	Seal Set Pair	5050 CL-20 20'		NA
1	Meeting Astragal SET	137 SA SET 84" SMS-TEKS 6 X 1"		NA

HW-4 CORRIDOR EXIT PAIR				
2	Continuous Hinge	661HD UL 90 1/2"	AL	ST
2	SVR Exit Device LBR	9400C 7FT CD L LB SNB	630	DM
1	Exit Device Trim	YC08 L	630	DM
1	Exit Device Trim	YC02R L	630	DM
2	Mortise Cylinder	1E-74 PATD-Cam as req.	626	BE
1	Rim Cylinder	12E-72 PATD R705	626	BE
2	Door Closer	QDC119 R S/TAP SN	689	SH
2	Kickplate Pair	K0050 8" x 1" LDW B4E CSK	630	TR
2	Dome Stop	1211	626	TR
1	Gasketing Set- Pair	137 SA SET 1 x 72" 2 x 84" SPH SMS 10 X 1 1/2"		NA
1	Meeting Astragal SET	137 SA SET 84" SMS-TEKS 6 X 1"		NA

HW-5 PRE-LOBBY EXIT PAIR-UL				
2	Continuous Hinge	661HD UL 90 1/2"	AL	ST
2	Exit Device	F9400C 7FT L LB	630	DM
2	Exit Device Trim	YC08 L	630	DM
2	Rim Cylinder	12E-72 PATD R705	626	BE
2	Door Closer	QDC119 R S/TAP SN	689	SH
2	Kickplate Pair	K0050 8" x 1" LDW B4E CSK	630	TR
2	Dome Stop	1211	626	TR
1	Seal Set Pair	5050 CL-20 20'		NA
1	Meeting Astragal SET	137 SA SET 84" SMS-TEKS 6 X 1"		NA
2	Electromagnet Holder	2100 1" EXTENSION 3/4" EXTENSION	US32D	AB
NOTE: Door Electromagnets must tie into the fire control panel. Electromagnet holds door open until Event triggers Fire alarm and then Magnets release allowing doors to close and latch for fire. Free egress at all times.				

HW-6 LOBBY EXIT TO STAIR-UL				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	F Rim Exit Device	F9300C L	630	DM
1	Exit Device Trim	YC08 L	630	DM
1	Rim Cylinder	12E-72 PATD R705	626	BE
1	Door Closer	QDC111 R S/TAP SN	689	SH
1	Kick Plate	K0050 8" x 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270WV	630	TR
1	Seal set	5050C Head & Jambs		NA

HW-7 STAIR TO EXTERIOR EXIT ONLY-UL				
3	Hinges	FBB199 4.5" x 4.5" NRP	32D	ST
1	F Rim Exit Device	F9300C L	630	DM
1	Exit Device Pull Trim	YP03 L	626	DM
1	Rim Cylinder	12E-72 PATD R705	626	BE
1	Door Closer	QDC119 R S/TAP SN	689	SH
1	HD Ext Floor Stop	1209HA	630	TR
1	Gasketing Set	137 SA SET 1 x 36" 2 x 87" SMS-TEKS 6 X 1"		NA
1	Door Sweep	200 SA 36" SMS-TEKS 6 X 1"		NA
1	Saddle Threshold	425 36" 1/4-20 MS/EA PA	AL	NA
1	Conc. Dr Contacts	By Alarm Supplier		BY
NOTE: Entry to Stairwell by key only.				

HW-8 PRE LOBBY EXIT TO EXT.				
3	Hinges	FBB199 4.5" x 4.5" NRP	32D	ST
1	Rim Exit Device	9300C CD L SNB	630	DM
1	Exit Device pull trim	YP03 L	626	DM
1	Mortise Cylinder	1E-74 PATD-Cam as req.	626	BE
1	Rim Cylinder	12E-72 PATD R705	626	BE
1	Door Closer	QDC119 R S/TAP SN	689	SH
1	Kick Plate	K0050 8" x 2" LDW B4E CSK	630	TR
1	HD Ext Floor Stop	1209HA	630	TR
1	Gasketing Set	137 SA SET 1 x 36" 2 x 87" SMS-TEKS 6 X 1"		NA
1	Door Sweep	200 SA 36" SMS-TEKS 6 X 1"		NA
1	Saddle Threshold	425 72" 1/4-20 MS/EA	AL	NA
1	Conc. OH Door Contacts	By Alarm Supplier		BY
NOTE: Entry by key from exterior only. Free Egress at all times.				

HW-9 RESTROOM				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	Push/Pull	1001-3 X 1018-3B CFC	630	TRIM
1	Door Closer	QDC111 R S/TAP SN	689	SH
1	Kick Plate	K0050 8" x 2" LDW B4E CSK	630	TR
1	Mop Plate	KM050 4" x 1" LDW B4E CSK	630	TR
1	Wall Bumper	1270WV	630	TR
1	Seal set	5050C Head & Jambs		NA

HW-10 MUSEUM ENTRY				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	Office Lockset	9K3-7AB14D PATD S3	626	BE
1	Door Closer w/ HO	QDC112 R S/TAP SN	689	SH
1	Wall Bumper	1270WV	630	TR
1	Seal set	5050C Head & Jambs		NA

HW-11 VEST 110 TO GREEN RM				
3	Butt Hinge	FBB179 4.5" x 4.5" NRP	26D	ST
1	Classroom Lockset	9K3-7R14D PATD S3	626	BE
1	Dome Stop	1211	626	TR
1	Seal set	5050C Head & Jambs		NA

HW-12 SINGLE TOILET				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	Privacy Set	9K3-0L14D S3	626	BE
1	Door Closer	QDC211 F S/TAP SN	689	SH
1	Kick Plate	K0050 8" x 2" LDW B4E CSK	630	TR
1	Mop Plate	KM050 4" x 1" LDW B4E CSK	630	TR
1	Wall Bumper	1270WV	630	TR
1	Seal set	5050C Head & Jambs		NA

HW-13 CONF. / VEST /GREEN RM ENTRY'S				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	Classroom Lockset	9K3-7R14D PATD S3	626	BE
1	Door Closer	QDC111 R S/TAP SN	689	SH
1	Kick Plate	K0050 8" x 2" LDW B4E CSK	630	TR
1	Dome Stop	1211	626	TR
1	Seal set	5050C Head & Jambs		NA

HW-14 RECEPTION				
3	Butt Hinge	FBB179 4.5" x 4.5" NRP	26D	ST
1	Office Lockset	9K3-7AB14D PATD S3	626	BE
1	Door Closer	QDC115 R S/TAP SN	689	SH
1	Dome Stop	1211	626	TR
1	Seal set	5050C Head & Jambs		NA

HW-15 OFFICE				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	Office Lockset (GR2)	7KC3-7AB14D PATD S3	626	BE
1	Wall Bumper	1270WV	630	TR
1	Seal set	5050C Head & Jambs		NA

HW-16 WORK RM				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	Classroom Lock (GR2)	7KC3-7R14D PATD S3	626	BE
1	Wall Bumper	1270WV	630	TR
1	Seal set	5050C Head & Jambs		NA

HW-17 SUPPLY RM				
3	Butt Hinge	FBB179 4.5" x 4.5" NRP	26D	ST
1	Storeroom Lock (GR2)	7KC3-7D14D PATD S3	BE	626
1	Wall Bumper	1270WV	630	TR
3	Silencer	1229A	GREY	TR

HW-18 AUDITORIUM EXITS-UL				
1	Continuous Hinge	661HD UL 90 1/2"	AL	ST
1	F Rim Exit Device	F9300C L	630	DM
1	Exit Device Trim	YC08 L	630	DM
1	Door Closer	QDC115 R S/TAP SN	689	SH
1	Kick Plate	K0050 8" x 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing Set	137 SA SET 1 x 36" 2 x 87" SMS-TEKS 6 X 1"		NA
1	Auto Door Bottom	220 SA 36" 14 X 1 1/2" SSWS		NA
1	1/4" x 3" Threshold	411 36" 1/4-20 MS/EA (For Auto DB)	AL	NA

HW-19 MECHANICAL / CUST.				
3	Butt Hinge	FBB179 4.5" x 4.5"	26D	ST
1	Storeroom Lockset (GR2)	7KC3-7D14D PATD S3	626	BE
1	Door Closer	QDC211 F S/TAP SN	689	SH
1	Wall Bumper	1270WV	630	TR
1	Seal set	5050C Head & Jambs		NA

END OF SECTION 08 7100

SECTION 08 8733 - ARCHITECTURAL WINDOW FILM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass with decorative film overlay.
2. Single patterned film (Fasara).

    a. Oslo or Milky Crystal.

1.2 REFERENCES

A. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.

B. ASTM International (ASTM):

1. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
2. ASTM E 308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
3. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

1.3 PERFORMANCE REQUIREMENTS

A. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:

1. Flame Spread Index: no greater than 25.
2. Smoke Developed Index: no greater than 450.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer's current technical literature on each product to be used, including:

1. Manufacturer's Data Sheets.
2. Preparation instructions and recommendations.

3. Storage and handling requirements and recommendations.
4. Installation methods.

B. Verification Samples: For each film specified, two samples representing actual film color and pattern.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of decorative film.

C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of each decorative film overlay to include in maintenance manuals.

1.8 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 installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.

1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:

    a. Name of building.
    b. The name and telephone number of a management contact.
    c. Type of glass.
    d. Type of film and/or film attachment system.
    e. Amount of film and/or film attachment system installed.
    f. Date of completion.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. 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. Follow Manufacturer's instructions for storage and handling.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install decorative glass until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative film by field measurements before fabrication.

1.11 WARRANTY

A. At project closeout, provide to Owner or Owner's Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

B. In order to validate warranty, installation must be performed by an Authorized 3M dealer and according to Manufacturer's installation instructions. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS OF DECORATIVE FILM

A. Decorative Film Overlay: Translucent, dimensionally stable, polyester film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide 3M Commercial Solutions; Fasara – Oslo or designation or a comparable product by one of the following:

    a. Avery Dennison.
    b. Avery Dennison Corporation; Graphics Solutions Division.
    c. Decorative Films, LLC.
    d. Eastman Performance Films, LLC.
    e. FDC Graphic Films, Inc.
    f. Solar Gard; Saint-Gobain.

B. Optical Performance: Frost/Matte and Mirror Series.

1. FASARA - OSLO Decorative / Privacy Glazing Film applied to 3mm thick clear glass (ASTM E 903, ASTM E 308):
2. Ultraviolet Transmittance: 0.1 percent.
3. Visible Light Transmittance: 83 percent.
4. Visible Light Reflectance - Interior: 9 percent.
5. Solar Heat Transmittance: 76 percent.
6. Solar Heat Reflectance: 8 percent.
7. Shading Coefficient at 90 Degrees (Normal Incidence): 0.92.

C. Decorative Film Overlay: Translucent, dimensionally stable, polyester film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide 3M Commercial Solutions; Fasara – Milky Crystal or designation or a comparable product by one of the following:

a. Avery Dennison.
b. Avery Dennison Corporation; Graphics Solutions Division.
c. Decorative Films, LLC.
d. Eastman Performance Films, LLC.
e. FDC Graphic Films, Inc.
f. Solar Gard; Saint-Gobain.

D. Optical Performance: Frost/Matte and Mirror Series.

1. Ultraviolet Transmittance: 0.1 percent.
2. Visible Light Transmittance: 19 percent.
3. Visible Light Reflectance - Interior: 42 percent.
4. Solar Heat Transmittance: 18 percent.
5. Solar Heat Reflectance: 31 percent.
6. Shading Coefficient at 90 Degrees (Normal Incidence): 0.40.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Film Examination:

1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

a. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.

2. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
3. Commencement of installation constitutes acceptance of conditions.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Film Installation, General:

1. Install in accordance with manufacturer's instructions.
2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
4. Apply film to glass and lightly spray film with slip solution.
5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.
8. If completing an exterior application, check with the manufacturer as to whether edge sealing is required.

3.4 CLEANING AND PROTECTION

A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION 08 8733

SECTION 08 8813 - FIRE-RATED GLAZING

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. Fire-protection-rated glazing.

B. Film-Faced Ceramic Glazing: Clear, Not Used, Not allowed.

1.3 DEFINITIONS

A. Fire-Protection-Rated Glazing: Glazing in rated doors and openings up to 45 minutes, limited in size, and not capable of blocking radiant heat.

B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

C. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and glass testing agency.

B. Product Certificates: For each type of glass and glazing product.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Tempered Glazing Units with Clear Intumescent Interlayer: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of tempered glazing units with clear intumenscent interlayer is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is air bubbles within units, or obstruction of vision by contamination or deterioration of intumescent interlayer.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: For each glass type, obtain from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F temperature-rise limitation; and fire-resistance rating in minutes.

C. FILM-FACED CERAMIC GLAZING: CLEAR, NOT USED, NOT ALLOWED.

D. Fire-Protection-Rated Tempered Glass **TYPE W**: 6-mm thickness; fire-protection-rated tempered glass; complying with 16 CFR 1201, Category II.

1. For wood and metal doors up to 20 min does not include sidelites.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Interedge; Pyro edge.
b. McGrory Glass, Inc.
c. SaftiFirst; Super Lite I.
d. Technical Glass Products; an Allegion brand; Fireglass 20.
e. Vetrotech Saint-Gobain.

E. Fire-Protection-Rated Laminated Ceramic Glazing **TYPE H**: Laminated glass made from two plies of clear, ceramic glass; 5/16” (8-mm) total thickness; complying with 16 CFR 1201, Category II.

1. For wood and metal doors up to 45 min including sidelites, Does not include stairwells borrow lite or stair well doors.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Interedge.
b. McGrory Glass, Inc.
c. Schott North America, Inc.
d. Technical Glass Products; an Allegion brand; Fire Lite Plus.
e. Vetrotech Saint-Gobain.

F. Fire-Protection-Rated Laminated Ceramic Glazing **TYPE OH**: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.

1. For wood and metal doors up to 45 min including sidelites, Does not include stairwells borrow lite or stair well doors.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Interedge.
    b. McGrory Glass, Inc.
    c. SaftiFirst; Pyran Platimun L.
    d. Schott North America, Inc.
    e. Technical Glass Products; an Allegion brand.
    f. Vetrotech Saint-Gobain.

G. Fire-Protection-Rated Laminated Glass with Intumescent Interlayer **TYPE T**: Laminated glass made from multiple plies of uncoated, low-iron float glass; with intumescent interlayers; complying with 16 CFR 1201, Category II.

1. Borrowed lites.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Interedge; Pyobel 45.
    b. McGrory Glass, Inc.
    c. Pilkington North America; NSG Group.
    d. SaftiFirst; Super Lite II-XL45.
    e. Technical Glass Products; an Allegion brand; Pyrostop 45.
    f. Vetrotech Saint-Gobain; Contraflam 45.

H. Fire-Protection-Rated Laminated Glass with Intumescent Interlayer TYPE W: Laminated glass made from multiple plies of uncoated, low-iron float glass; with intumescent interlayers; complying with 16 CFR 1201, Category II.

1. Borrowed lites, windows in fire rated aluminum frames.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Interedge; Pyobel 45-120.
    b. McGrory Glass, Inc.
    c. Pilkington North America; NSG Group.
    d. SaftiFirst; Super Lite II-X 45-120.
    e. Technical Glass Products; an Allegion brand; Pyrostop 45-120.
    f. Vetrotech Saint-Gobain; Contraflam 45-120.

2.6 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. GE Construction Sealants; Momentive Performance Materials Inc.
    b. The Dow Chemical Company.
    c. Tremco Incorporated.

2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; 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; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

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.

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. 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.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. 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.

D. 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.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. 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.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: 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.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. 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.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces 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 08 8813

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies, including, but not limited to the following:

a. Walls and partitions.
b. Suspended ceilings and soffits
c. Furring framing (framing not extending to floor).

2. Suspension systems for interior gypsum ceilings, soffits, and grid systems other than those listed below.

a. Suspended ceilings and soffits.
b. Suspensions system for suspended clouds.
c. Other areas other than interior stud walls.

B. Related Sections:

1. For the framing associated with the following conditions refer to Section 05 4000 Cold Formed Metal Framing:

a. Interior Conditions:

1) Load Bearing.

b. Exterior Conditions:

1) Load Bearing.
2) Non-load bearing wall framing.
3) Ceiling, soffit and furring framing.
4) Ceiling joist framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For cold-formed steel framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional, Georgia licensed engineer responsible for their preparation.

C. Shop Drawings: Submit, as part of shop drawing review phase of the project, structural engineer design narrative and structural engineering calculations for light gage metal framing system proposed to be used for exterior framing, interior structural framing and interior suspended, furred framing.

1. Indicated size, gages, and spacing of framing materials to be used.
2. Indicate method (type, size and spacing) of attachment of framing to building structure.
3. Indicate methods by which suspended and furred walls and ceilings are to be supported from the structure.
4. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
5. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
6. Provide a complete elevation of each wall show stud spacing, location of bracing state stud size and gauge, state size of top and bottom track.
7. Shop Drawing: Provide shop drawing showing location of control joints.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For embossed, high-strength steel studs and tracks, firestop tracks, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.

2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Studs and Tracks:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) ClarkDietrich Building Systems.
2) MBA Building Supplies.
3) Telling Industries.
4) The Steel Network, Inc.

b. Depth: 3-5/8 inches.

1) Minimum Base-Metal Thickness: 0.033 inch; 20 gauge; walls up to 13’-6”.
2) Minimum Base-Metal Thickness: 0.043 inch; 18 gauge; walls up to 14’-9”.
3) Minimum Base-Metal Thickness: 0.053 inch; 16 gauge; walls up to 15’-9”.

c. Depth: 6 inches.

1) Minimum Base-Metal Thickness: 0.033 inch; 20 gauge; walls up to 20’-10”.
2) Minimum Base-Metal Thickness: 0.043 inch; 18 gauge; walls up to 22’-9”.

C. Slip-Type Head Joints: Where indicated, provide the following:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) ClarkDietrich Building Systems.
2) Fire Trak Corp.
3) Marino\WARE.
4) MBA Building Supplies.
5) Superior Metal Trim; Superior Flex Track System (SFT).
6) Telling Industries.
7) The Steel Network, Inc.

2. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.

D. Firestop Tracks: Top track 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
b. Grace Construction Products; FlameSafe FlowTrak System.
c. Marino\WARE.
d. Metal-Lite, Inc.; The System.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.
b. Marino\WARE.
c. MBA Building Supplies.
d. Telling Industries.

2. Minimum Base-Steel Thickness: 0.0329 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.
b. Marino\WARE.
c. MBA Building Supplies.
d. Telling Industries.

2. Depth: 1-1/2 inches.
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.
b. Marino\WARE.
c. MBA Building Supplies.
d. Telling Industries.

2. Minimum Base-Steel Thickness: 0.0329 inch.
3. Depth: 7/8 inch.

H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.

b. Marino\WARE.
c. MBA Building Supplies.
d. Telling Industries.

2. Configuration: Asymmetrical or hat shaped.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.
b. Marino\WARE.
c. MBA Building Supplies.
d. Telling Industries.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.033 inch.
b. Depth: 1-5/8 inches.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

1. Minimum Base-Metal Thickness: 0.033 inch.
2. Configuration: hat shaped.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling 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.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. 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.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.

2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Sound-Attenuation Blankets.
4. Acoustical joint sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.3 INFORMATION SUBMITTALS

A. Certificate of Compliance: Submit, as part of Shop Drawings, certification from manufacturer of product or materials furnished herein, stating that product(s) and / or material (s) being furnished comply with technical provisions contained herein.

1. Any and all deviations from technical provisions of specifications shall be specifically noted.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Contact Architect prior to installing gypsum board. Review locations of control joint and type of edge trim used at each location.

1. Provide control joints where gypsum board meets dis-similar material.
2. Provide control joints where gypsum board is 20 feet or more in any one direction.
3. Provide control joints in ceilings where soffits change direction from inside corner.
4. Provide additional control joints as directed by Architect on site. Coordinate requirements with light gauge framing.

D. Do not install panels that are wet, moisture damaged, and mold damaged.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

1. Gypsum Association “Fire Resistance Design Manual; sound control.”

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1. Gypsum Association “Fire Resistance Design Manual; sound control.”

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corp.
2. Georgia-Pacific Gypsum LLC.
3. Lafarge North America Inc.
4. National Gypsum Company.
5. Temple-Inland.
6. USG Corporation.

B. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

D. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.

E. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

F. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

G. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X. where required
2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
5. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274
8. Gypsum board in the following areas shall be high impact-resistant gypsum board:

    a. Interior walls and partitions:

        1) All areas.

    b. Soffits, furring and high walls in the following areas:

        1) Gymnasium.
        2) Weight room.
        3) Dressing rooms.
        4) Vocational classrooms and labs.

c. Other locations where indicated.

9. Where high impact gypsum board indicated to be used the following shall apply

a. Extend reinforced gypsum board from finished floor to ceiling height.
b. Gypsum board above ceiling height not required to be reinforced gypsum board.

2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corp.; ProRoc Type C.
b. Georgia-Pacific Gypsum LLC; Fireguard C.
c. Lafarge North America Inc.; Firecheck Type C.
d. National Gypsum Company; Gold Bond Fire-Shield C.
e. Temple-Inland; Type TG-C.
f. USG Corporation; Firecode C Core.

2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C-Cure; C-Cure Board 990.
b. CertainTeed Corp.; FiberCement.
c. Custom Building Products; WonderBoard.
d. James Hardie Building Products, Inc.; HardieBacker Cement Board.
e. National Gypsum Company, Permabase Cement Board.
f. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, 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. Thickness: Thickness as indicated on Drawings. If not indicated, as follows:

a. In Stud Partitions: Full Thickness of wall or partition.
b. Above Ceilings: 3".

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSCF.
c. Pecora Corporation; AC-20 FTR.
d. Specified Technologies, Inc.; Smoke ‘N’ Sound Acoustical Sealant.
e. USG Corporation; SHEETROCK Acoustical Sealant.

F. Thermal Insulation: As specified in Section 07 2100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

D. Gypsum board install prior to closing the exterior envelope (Windows not installed) and the climate control system operating and areas that require “Pre-Rock”, Moisture and Mold-Resistant Gypsum Board shall be used.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

K. Gypsum board panels to be installed as indicated on drawings and as specified herein. Where conflicts existing between provisions of the contract, the more stringent requirement shall govern.

L. Gypsum board panels to be installed as follows:

1. Interior Wall Applications: Extend gypsum board full height of wall, both sides.
2. Exterior Wall Applications: Extend gypsum board full height of wall, both sides.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: Where required for fire-resistance-rated assembly.
3. Flexible Type: Apply in double layer at curved assemblies.
4. Ceiling Type: As indicated on Drawings.
5. Impact-Resistant Type: At all locations below 10 feet.
6. Mold-Resistant Type: As indicated on Drawings.
7. Type C: Where required for specific fire-resistance-rated assembly indicated.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.

2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. 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 TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated and where panel meets adjacent surfaces.
4. U-Bead: Use at exposed panel edges.
5. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Not used.
4. Level 4: At panel surfaces that will be exposed to view .at areas that are not occupied secondary spaces, closets, storage, etc.

    a. Level 4 finish is achieved by using the gypsum construction handbook and the following requirements:

1) 1st coat embedded.
2) 2nd coat fill.
3) 3rd coat level coat.
4) 4th finish coat.
5) Sanding is required between 3rd and 4th coat and after 4th coat.
6) Each coat is a separate operation. Coats may not be combined.
7) Minimum of three coats over fasteners.

5. Level 5: all areas exposed to view Unless otherwise noted.

a. Level 5 finish is achieved by using the gypsum construction handbook and the following requirements:

1) 1st coat embedded.
2) 2nd coat fill.
3) 3rd coat level coat.
4) 4th finish coat.
5) 5th coat skim.
6) Sanding is required between 4th and 5th coat.
7) Each coat is a separate operation and may not be combined.
8) Minimum of 4 coats over fasteners.
9) Skim coat is the operation of applying joint treatment compound to cover the entire surface of gypsum wall board including joints so as not paper is visible. This operation is trowel applied. Roller or spray type products will not be accepted as “skim coat”. Finish and sand with 220 or wet sand. Tough-up as needed where holiday of gypsum board paper shows.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

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

END OF SECTION 09 2900

SECTION 09 3013 - 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. Porcelain tile.
2. Quarry tile.
3. Ceramic wall tile.
4. Thresholds.
5. Stone window stools.
6. Metal Edge Strips.
7. Crack isolation membranes.

B. Related Requirements:

1. Section 09 2900 "Gypsum Board" for tile backing panels.
2. Refer to Finish Schedule on Drawings.

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. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

D. TCNA: Tile Council of North America, Inc.

E. Thin Set: The term "Thin Set" is used to describe the method of installing tile with a bonding material usually 3/32" to 1/8" thickness. The term thin-set may be used interchangeably for "dry-set" portland cement mortar.

F. Wet Area: For the purposes of this section a "wet" area shall be defined as "tile surfaces that are either soaked, saturated, or subjected to moisture or liquids (usually water) such as would be found in shower enclosures, gang showers, tub enclosures, dressing rooms, can wash, laundries, steam rooms, exterior areas, and other areas defined on the drawings.

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.

1. Direction, location, and amount of floor slope.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Stone thresholds in 6-inch lengths.
3. Metal edge strips in 6-inch 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: Engage an installer, with a minimum of 5 years of successful commercial tile installations similar in material, design, and scope to that indicated.

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.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

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 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 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. Crack isolation membrane.
3. Joint sealants.
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 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.

E. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

2.3 TILE PRODUCTS

A. Tile Types

1. PT - Porcelain.
2. QT - Quarry Tile.
3. CT - Ceramic Wall Tile.

B. Tile Type PT-__: Unglazed floor tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile; Industrial Park or a comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Crossville, Inc.
c. Interceramic.

2. Composition: Porcelain through body.
3. Face Size: 12 by 12 inches.
4. Thickness: 3/8 inch.
5. Color: Price Group III.
6. Face: Plain with square edges.
7. Pattern: As indicated on Drawings.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cove: Cove, module size same as adjoining flat tile. Size shall be module of adjacent tile, Floor.
b. External cove base Corners for Thin-Set Mortar Installations: Surface bullnose, module size.
c. Internal Corners: Field-Mitered square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

C. Tile Type QT-__: Unglazed quarry tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Dale Tile or comparable Custom-made Products by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Crossville, Inc.
c. Interceramic.

2. Composition: Through body fired clay.
3. Face Size: 8 by 8 inches.
4. Thickness: 1/2 inch.
5. Color: Price group III.
6. Face: Plain with square edges.
7. Pattern: As indicated on Drawings.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cove: Cove, module size same as adjoining flat tile. Size shall be module of
b. adjacent tile, Floor.
c. External cove base Corners for Thin-Set Mortar Installations: Surface bullnose, module size.
d. Internal Corners: Field-Mitered square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

A. Tile Type CT-__: Ceramic Wall Tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile; Industrial Park or a comparable product by one of the following:

    a. American Olean; Division of Dal-Tile International Inc.
    b. Crossville, Inc.
    c. Interceramic.

2. Up to 6 colors.

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 above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 10 according to ASTM C1353 or ASTM C241/C241M and with honed finish.

1. Description:

    a. Match Architect's sample.

2.5 WINDOW STOOLS

A. Stools to be of either "natural" or "reconstructed" marble of color to match marble thresholds and in compliance with the following:

1. Fabricate to size and shapes indicated on Drawings.
2. Fabricate with beveled edges (1/4") and rounded corners.
3. Thickness to be 3/4" thick unless noted.
4. Length to be as required to extend full rough opening of window. Use maximum length section.

2.6 METAL EDGE STRIPS

A. Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

1. Edge Protection and Transition Profiles:

    a. Provide at all base to floor locations, top of wainscot, external corners, internal corners at walls.

2. Depth and style required for tile setting and thickness.
3. Angle or "T"-type for adhesive bonding to substrate.
4. Basis-of-Design Product: Provide the Schluter System:

    a. Floor to wall: DILEX-HK.

b. Wall external corner: RONDEC.
c. Walls Internal corner: DILEX-HKW.
d. Edge of tile: RONDEC-DB.
e. Control joints: DILEX-AKWS.
f. Stair Nosing: TREP-SE.

2.7 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product, selected from the following, 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. Crack Isolation Membrane, Fabric-Reinforced, Fluid-Applied: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boiardi Products; a QEP company; Elastiment 344 Reinforced Waterproofing and Anti-Fracture/Crack Suppression Membrane.
b. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
c. Bostik, Inc.; Hydroment Blacktop 90210.
d. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
e. Laticrete International, Inc.; Laticrete Blue 92 Anti-Fracture Membrane.
f. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh.
g. Mer-Kote Products, Inc.; Hydro-Guard 2000.

2.8 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonsal American; an Oldcastle company.
b. Bostik, Inc.
c. Custom Building Products.

d. Laticrete International, Inc.
e. MAPEI Corporation.
f. Southern Grouts & Mortars, Inc.
g. TEC; a subsidiary of H. B. Fuller Company.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

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. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX Americas.
b. C-Cure.
c. Custom Building Products.
d. H.B. Fuller Construction Products Inc. / TEC.
e. Laticrete International, Inc.
f. MAPEI Corporation.
g. Sakrete; CRH Americas, Oldcastle APG.
h. Southern Grouts & Mortars, Inc.

2. Polymer Type:

a. Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.10 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 07 9200 "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; Dow Corning 786.
b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
c. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
e. Tremco Incorporated; Tremsil 600 White.

2.11 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. 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.

C. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonsal American; an Oldcastle company; Grout Sealer.
b. Bostik, Inc.
c. Custom Building Products.
d. Laticrete International, Inc.
e. Sakrete; CRH Americas, Oldcastle APG.
f. Southern Grouts & Mortars, Inc.
g. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

2.12 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 bonded mortar bed or 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 waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot 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.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF CERAMIC TILE

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.

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. 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.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Porcelain Tile: 1/8 inch.
2. Quarry Tile: 1/4 inch.
3. Ceramic Wall Tile: 3/16 inch.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. 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.

H. 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 latex-Portland cement mortar (thin set).
2. Do not extend crack isolation membrane under thresholds set in latex-Portland cement mortar. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.

I. Metal Edge Strips: Install 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.

J. 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 INSTALLATION OF CRACK ISOLATION MEMBRANES

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.

3.5 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. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

3.6 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.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
1. Tile Installation: Thin-set mortar on crack isolation membrane; TCA F125 Partial.

    a. Tile Type: Floor tile Interior slab on grade.
    b. Thin-Set Mortar: Latex- portland cement mortar.
    c. Bonded water proof membrane.
    d. Grout: Polymer-modified sanded grout.

2. Tile Installation: Thin-set mortar on Water proof membrane; TCA F122A.

a. Tile Type: Floor tile Suspended Slab.
b. Thin-Set Mortar: Latex-portland cement mortar.
c. Bonded water proof membrane.
d. Grout: Polymer-modified sanded grout.

3. Interior Floor Installations, Concrete Subfloor (Mud Set): Tile Installation F121-14.

a. Location:
b. Tile Type: Quarry Tile.
c. Unbounded: Mortar Bed.
d. Bonded water proof membrane.
e. Grout: Polymer-modified sanded grout.

B. Interior Wall Installations, Masonry or Concrete:

1. Tile Installation W201 with no membrane.

a. Tile Type: CT.
b. Thin-Set Mortar: Latex- Medium-bed, latex-portland cement mortar.
c. Grout: Polymer-modified sanded grout.

END OF SECTION 09 3013

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for interior ceilings.

B. Extent of each type of acoustical ceiling shown and scheduled on Drawings.

C. Types of acoustical ceilings specified in this section include following:

1. Acoustical panel ceilings, exposed suspension.
2. Gypsum Lay-in panels

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Coordination Drawings:

1. Submit reflected ceiling plans, prepared by Installer for installation purposes, drawn accurately to scale and coordinated with related mechanical, electrical and other work above, penetrating, or connected to acoustical ceiling.

2. Develop a drawing, at 1/8 inch = 1 foot and show as a minimum, the following:

a. Location of each type of ceiling tile and grid systems to be utilized.
b. Location of ceiling suspension members, cross members, and method of anchorage to building structure of hangers.
c. Location of ceiling-mounted work including sprinkler heads, light fixtures, diffusers, grilles, and special moldings.

1) Obtain plumbing, mechanical, and electrical layouts from engineering drawings.
2) Obtain Sprinkler System layouts from Sprinkler shop drawings.

C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.
3. Clips: Full-size hold-down, impact and seismic clips.

E. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

a. Lighting fixtures.
b. Diffusers.
c. Grilles.
d. Speakers.
e. Sprinklers.
f. Access panels.
g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.

E. Field quality-control reports.

F. Certificate of Compliance: Submit, as part of Shop Drawings, certification from manufacturer of product or materials furnished herein, stating that product(s) and / or material (s) being furnished comply with technical provisions contained herein.

1. Any and all deviations from technical provisions of specifications shall be specifically noted.

G. Asbestos Certification: Submit as part of shop drawings, and later as part of close-out documents, letter from each manufacturer of products furnished under this section indicating that products furnished are 100% free from asbestos containing materials.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.
4. Impact Clips: Equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling panels carefully to avoid chipping edges or damaging panels in any way.

1.9 FIELD CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space enclosed and weatherproof, wet-work in space completed and nominally dry, work above ceilings complete, and ambient conditions of temperature and humidity continuously maintained at values near those indicated for final occupancy.

B. Completed Work: Prior to installing materials specified in this section the following work shall be completed and systems noted operational:

1. Building envelope (walls, roof, and openings) completed to the extent where the building is dry and ready for installation of finishes.
2. HVAC system components complete and system operational.
3. Work above ceilings, including fire safing, completed and inspected by authorities having jurisdiction.

C. Commencing at the time of installation of materials herein specified and extending continuously to the date of final acceptance, the contractor shall maintain temperature of building between 65F and 80F, with relative humidity less than 50%.

1.10 EXTRA MATERIALS

A. Deliver extra materials to Owner.

B. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with appropriate labels.

C. Acoustical Ceiling Panels: Furnish quantity of full size panels equal to 2 percent of amount installed.

D. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2 percent of amount installed.

1.11 WARRANTY

A. Ceiling Panel Types AT and CAT only - Manufacturer's Written Warranty:

1. 10 years against sagging and warping of ceiling panels in temperatures up to 104 degrees F and in unlimited relative humidity conditions except exterior application and direct exposure to moisture or standing water.
2. Applies to conditions before and after installation of ceiling panels.

B. Suspension System Only- Manufacturer's Written Warranty:

1. 10 years against Rust in temperatures up to 120 degrees F and unlimited relative humidity conditions except exterior applications and direct exposure to moisture or standing water. Applies to conditions before and after installation of Suspension System.

C. Warranty shall not deprive the Owner of rights the Owner may have under other provisions of the contract documents.

1. The warranty shall be in addition and shall run concurrently with other warranties made by the contractor under the requirements of the contract documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design seismic restraints for ceiling systems.

B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANEL CEILING, GENERAL

A. Standard for Acoustical Ceiling Panels: Provide manufacturer's standard panels of configuration indicated, prepared for mounting method designated and complying with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).

1. Mounting Method for Measuring NRC: No. 7 (mechanically mounted on special metal support), FS SS-S-118; or Type E-400 mounting as per ASTM E 795.

B. Sound Attenuation Performance: Provide acoustical ceiling panels with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling panel of configuration indicated (concealed for tile, exposed for panels).

C. Colors, Textures, and Patterns: Provide products to match appearance characteristics indicated or, if not otherwise indicated, selected by Architect from manufacturer's standard colors, surface textures, and patterns available for acoustical ceiling panels and exposed metal suspension system members of quality designated.

2.4 ACOUSTICAL PANELS

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Type AT: Mineral Composition - Wet-formed mineral fiber panels, Fissured and Perforated Pattern, Non-Fire Resistance Rated, High Acoustics:

1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; Radar Acoustical Panels, Climaplus Performance, Model No. 2210 or a comparable product by one of the following:

    a. American Gypsum.
    b. Armstrong Ceiling & Wall Solutions.
    c. Cardinal Acoustics, Inc.
    d. Certainteed; SAINT-GOBAIN.
    e. Rockfon; ROCKWOOL International.

2. Classification: Provide panels as follows:

    a. Type and Form: Type III, Form 2.
    b. Pattern: CE (perforated, small holes and lightly textured).
    c. Color: White.
    d. Fire rating: Class A.
    e. Light Reflectance (LR): Not less than 0.84.
    f. Ceiling Attenuation Class (CAC): Not less than 33.
    g. Noise Reduction Coefficient (NRC): Not less than 0.55.
    h. Edge/Joint Detail: Square.
    i. Thickness: 5/8 inch.
    j. Modular Size: 24 by 24 inches.
    k. Maintenance: Can be cleaned easily with a soft brush or vacuum.

3. Antimicrobial Treatment: Contains a broad-spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew. Includes sag-resistance performance.

C. Type GLP: Gypsum Panels - Gypsum Core, with Vinyl Facing, Stippled Pattern, Fire Resistant Rated:

1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; USG Sheetrock Brand Lay-In Gypsum Ceiling Panels, Climaplus Performance, Model No. 3260 or a comparable product by one of the following:

    a. CertainTeed, Saint-Gobain.
    b. Vinyltone Vinyl Faced Gypsum Lay-in Panels, Celotex Corp., Jim Walter Co.
    c. Gridstone Vinyl Laminated Gypsum Panels, Gold Bond Products, Div. National Gypsum Co.

2. Classification: Provide panels as follows:

a. Type and Form: Type XX, Pattern G.
b. Pattern: CE (perforated, small holes and lightly textured).
c. Color: White.
d. Fire rating: Class A.
e. Light Reflectance (LR): Not less than 0.77.
f. Ceiling Attenuation Class (CAC): Not less than 35.
g. Noise Reduction Coefficient (NRC): N/A.
h. Edge/Joint Detail: Square.
i. Thickness: 1/2 inch.
j. Modular Size: 24 by 24 inches.

D. Type CAT: Mineral Composition - Wet-formed, ceramic-bonded mineral fiber, with cleanable finish, perforated, small holes, lightly textured:

1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; USG Radar Ceramic Acoustical Panels, Climaplus Performance, Model No. 56644 or a comparable product by one of the following:

a. American Gypsum.
b. Armstrong Ceiling & Wall Solutions.
c. Cardinal Acoustics, Inc.
d. Certainteed; SAINT-GOBAIN.
e. Rockfon; ROCKWOOL International.

2. Classification: Provide panels as follows:

a. Type and Form: Type XX.
b. Pattern: CEG.
c. Color: White.
d. Fire rating: Class A.
e. Light Reflectance (LR): Not less than 0.82.
f. Ceiling Attenuation Class (CAC): Not less than 40.
g. Noise Reduction Coefficient (NRC): Not less than 0.50.
h. Edge/Joint Detail: Square.
i. Thickness: 5/8 inch.
j. Modular Size: 24 by 24 inches.

3. Antimicrobial Treatment: Contains a broad-spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew. Includes sag-resistance performance.

2.5 METAL SUSPENSION SYSTEM, GENERAL

A. Standard for Metal Suspension Systems: Provide commercial quality hot dipped galvanized metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.

B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.

1. For exposed suspension members and accessories with painted finish, provide color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's full range of standard colors.

C. High Humidity Finish: Pre-painted aluminum cap over grid members for applications as follows:

1. Gypsum lay-in panels (Type GLP).
2. Ceramic-bonded mineral fiber lay-in panels (Type CAT).

D. Edge Moldings and Trim: Metal or extruded plastic of types and profiles indicated or, if not indicated, provide manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.

1. Unless noted or detailed otherwise, edge molding to be of angle shape with 1" exposed face.
2. For lay-in panels with reveal edge details, for Type AT ceilings, and elsewhere as indicated, provide stepped edge (shadow line) molding which forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For narrow faced suspension systems, provide suspension system manufacturer's standard edge moldings which match width and configuration of exposed runners.

2.6 EXPOSED METAL DIRECT-HUNG SUSPENSION SYSTEMS

A. Non-Fire-Resistance-Rated Double Web Steel Suspension System: Manufacturer's standard system roll-formed from prefinished cold-rolled hot dipped galvanized steel sheet with 15/16" wide exposed faces on structural members; other characteristics as follows:

1. Structural Classification: Provide structural classification indicated:

a. Intermediate-Duty System Application:

1) All ceiling types unless indicated otherwise.

b. Heavy-Duty System Application:

1) Sub-ceiling systems including gypsum drywall support systems.
2) Gypsum Lay-In Panels (GLP).

2. System Type:

a. Provide Standard type system unless otherwise noted.
b. Provide gypsum drywall support system at suspended gypsum board ceilings unless other type system
c. detailed or specified.

3. Finish: Provide corrosion resistant ceiling grid of finish type indicated:

a. Painted, Low Sheen White Application:

1) All ceiling types unless indicated otherwise.

b. Aluminum Cap, Painted Low Sheen White Application:

1) GLP ceilings.

B. Fire-Resistance-Rated Double Web Steel Suspension System: Manufacturer's standard system roll-formed from prefinished cold-rolled hot dipped galvanized steel sheet with 15/16" wide exposed faces on structural members; other characteristics to match non-rated system.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Manufacturers of Non-Fire-Resistance-Rated Double Web Steel Suspension Systems:

1) Armstrong World Industries, Inc.
2) BPB Celotex.
3) Chicago Metallic Corporation.
4) Donn USG Interiors.

b. Manufacturers of Fire-Resistance-Rated Double Web Steel Suspension Systems:

1) Armstrong World Industries, Inc.
2) BPB Celotex.
3) Chicago Metallic Corporation.
4) Donn USG Interiors.

2.7 MISCELLANEOUS MATERIALS

A. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.

B. Concrete Inserts: Inserts formed from hot-dipped galvanized sheet steel and designed for attachment to concrete forms and for embedment in concrete, with holes or loops for attachment at hanger wires.

C. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, prestretched, Class 1 coating, sized so that stress at 3-times hanger design loan (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide min. gages as indicated:

1. Finished ceiling grid hanger wire:

a. Light Ceilings (Type AT): Min. 12 gage.
b. Heavy Ceilings (Type GLP): Min. 10 gage.

2. Sub ceiling grid hanger wire:

a. All Conditions: Min. 8 gage.

3. 3. Suspended Gypsum Board:

a. Vertically and Horizontally: Min. 8 gage

D. Hold-Down Clips for Rated and Non-Fire-Rated Ceilings: Provide hold-down clips spaced 2'-0" o.c. on all cross tees in locations indicated:

1. For interior ceilings composed of lay-in panels weighing less than 1 lb./s.f. where ceiling where part of a fire rated assembly or smoke tight assembly.
2. Sub ceilings where insulation is located immediately above and in contact with sub ceiling.
3. Elsewhere where indicated.

E. Impact Clips: Where indicated provide manufacturer's standard impact clip system designed to absorb impact forces against lay-in panels.

1. Unless noted otherwise use impact clips to retain ceiling where acoustical ceiling indicated in Weight Rooms, Gymnasiums (including auxiliary rooms), P.E. Facilities and multi-purpose rooms.

F. Drywall Clip: Where acoustical tile ceiling is specified to be installed below a gypsum board ceiling or fire rated assembly provide drywall anchor clip on face of gypsum board ceiling to allow for attachment of suspended acoustical tile ceiling grid hanger wires without penetration of fire rated assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Gypsum Drywall clip shall be similar to National Rolling Mills DWC Clip.
b. Chicago Metallic Corporation.
c. Donn USG Interiors.
d. Armstrong World Industries, Inc.

G. Column Collar: Where Acoustical Tile abut round or partially round concrete columns provide preformed Column Trim of inside dimension to match column diameter.

1. Column Collar to be Single piece extruded aluminum of finish to match ceiling grid.
2. Size: Provide edge moldings fabricated to diameter required to fit penetration exactly.
3. Style: 3/4" Reveal Edge; of type to accommodate ceiling specified.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Alabama Metal Industries.
2) Gordon Interior Specialties.
3) Fry Reglet Corporation.
4) MM Systems Corporation.

2.8 ACOUSTICAL SEALANT

A. Acoustical Sealant: Resilient, non-staining, non-shrinking, non-hardening, non-skinning, non-drying, non-sag sealant intended for interior sealing of concealed construction joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BA-98; Pecora Corp.
b. Tremco Acoustical Sealant; Tremco.
c. Norseal V-730; Norton.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PROJECT CONDITIONS

A. Refer to Part 1 above for project conditions which shall exist prior to installation of materials herein specified. The contractor shall be solely responsible for determining if the building is ready for installation of materials.

1. Materials damaged as a result of premature installation, whether a result of physical damage, corrosion, cupping, warpage, or other factors, shall be replaced at no cost to the contract.

3.3 PREPARATION

A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling.

1. Avoid use of less-than-half width units at borders.
2. Comply with reflected ceiling plans wherever possible.

3.4 INSTALLATION

A. General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and CISCA standards applicable to work.

B. Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans or if no reflective ceiling plans provided, as noted herein.

1. Install tile with pattern running in one direction.

C. Fire Rated Units: Where ceiling is indicated to be part of fire rated assembly, install grid, panels and accessories in accordance with applicable U.L. Design number. Penetrations through ceiling shall be with appropriate rated sealant; recessed fixtures to be protected with approved rated "housings".

1. If not indicated otherwise protect recessed fixtures in accordance with U.L. Design Number P225.

D. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members and in accordance with the following:

1. Locate hangers min. 6" from each end and 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".
2. Provide additional hangers at each corner of grid supporting light fixtures, HVAC grilles or similar ceiling mounted items.
3. Support wire shall be of single piece units of length required; splices in support wire not permissible.

E. Ceiling Expansion Joints: Where indicated or where required by manufacturer provide perimeter expansion joint system of type and configuration recommended by manufacturer. Provide, as min., perimeter ceiling expansion joints as follows:

1. Where cementitious panels indicated to be used; full perimeter of ceiling.
2. Install in a manner to allow for 1" of movement.

F. Drywall Clip: Where acoustical tile ceiling is specified to be installed below a gypsum board ceiling or fire rated assembly provide drywall anchor clip on face of gypsum board ceiling to allow for attachment of suspended acoustical tile ceiling grid hanger wires without penetration of fire rated assembly.

1. Screw attach dry wall clip through gypsum board to gypsum board support system
2. Do not penetrate gypsum board fire rated assembly with hanger wires for acoustical tile ceiling grid.

G. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices secure and appropriate for substrate, and not deteriorate or fail with age or elevated temperatures.

1. A all points of attachment, wire supports shall be bent, using pliers, to form a sharp 180 degree bend. Loose end of wire to be turned (wrapped) around hanger wire a min. of five (5) full turns.
2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum not part of supporting structural or ceiling suspension system.
3. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, counter splaying or other equally effective means.

H. Main and Cross Tees: Install main and cross tees in accordance with the following:

1. Main and cross tees shall be installed straight, true and square within room.
2. Grid shall be level to within 1/8" in 12'-0".
3. Install 2 main runners for each ceiling span.
4. Coordinate direction of main runner with light fixtures so that main runners occur on each end of recessed light fixtures.

I. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.

J. Attach moldings to substrate at max. intervals of 16" o.c. and max. 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0".

1. Miter corners accurately and connect securely.
2. Use power driven nails or other fastening methods as recommended by grid manufacture for applications
3. and substrates indicated.
4. Install fasteners in manner so as to avoid damage to partitions to which grid is attached.
5. Repair or replace partitions where damaged from installation of ceiling grid.

K. Sealant Bed: Provide sealant bead at underside of grid between grid and surface of wall where indicated and as required to provide a finished appearance and to comply with applicable codes and regulations. Where sealant is utilized the sealant shall be continuous around the perimeter of the space. Provide sealant, as a minimum, in the following locations:

1. Where required to maintain specified partitions ratings (acoustical, smoked and fire).
2. At music, choral, band, practice, auditoriums and other similar type rooms and spaces.
3. Where a gap exists between face of wall and back leg of ceiling due to irregularities in the face of the wall or in the installation of the grid.

L. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members.

1. Scribe and cut panels to fit accurately at borders and at penetrations.
2. Place edges of panels in close contact with metal supports and in true alignment.
3. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

M. Penetrations through Panels: Where Pipes or conduits penetrate ceiling the contractor shall:

1. Cut tile carefully, with cut out matching penetration size.
2. Caulk Around pipe penetration; where panels are fire rated, sealant to be rated.
3. Provide two piece escutcheon ring of color to match ceiling; secure to ceiling tile.
4. If tile must be cut to allow for installation of panel, provide ceiling grid member to fully support panel and conceal cut.

N. Ceiling Height Transitions: Where transitions in ceiling height are shown or required to accommodate conditions, the contractor shall construct transitions using 5/8" gypsum board on 3-5/8" metal studs.

1. Gypsum Board furring shall extend 2" below lower ceiling level; 4" above upper ceiling.
2. Use of acoustical tile turned vertically to create transition not acceptable.

3.5 CLEANING

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

1. Remove and replace work not successfully cleaned and repaired to permanently eliminate evidence of damage.

3.6 DAMAGED MATERIAL

A. Ceiling panels found to be damaged shall be removed and replaced at no cost to the owner. Materials considered to be damaged include, but are not limited to:

1. Panels found to be stained, soiled, discolored, or of non-uniform finish.
2. Panels found to be chipped, nicked, dented, or of non-uniform face texture.
3. Panels found to be warped, bowed, or twisted.

B. Ceiling grid found to be damaged shall be removed and replaced at no cost to the owner. Materials considered to be damaged include, but are not limited to:

1. Grid found to be stained, soiled, discolored, or of non-uniform finish.
2. Grid found to be chipped, nicked, dented, or of non-uniform face texture.
3. Grid found to be bent, warped, bowed, or twisted.
4. Grid found to be corroded.

C. Contractor shall note that the determination as to whether the building is ready for installation of ceiling tile and grid is solely that of the contractor. Materials damaged as a result of excessive humidity or moisture in the building shall be replaced by the contractor at no cost to the owner.

1. Field painting of ceiling grid is not an acceptable remedy for grid found to be corroded.

END OF SECTION 09 5113

SECTION 09 6400 – STAGE WOOD FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Stage and steps as shown on Drawings.
2. Stage Wood Flooring:

    a. Stage Wood Flooring system, including sleepers.
    b. Stage base, nosing, trim and boarder.
    c. Steps treads, risers, base, skirt.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Submit manufacturer's detailed technical product data and installation instructions for each type of wood flooring.
2. Include instructions for handling, storage, installation, finishing, protection and maintenance.

B. Samples: Submit following samples for each species and cut. Approved sample shall be representative of the final finished floor after installation.

1. Submit sets of range samples for each type of wood flooring.
2. Include finish where factory finished flooring required.
3. Include samples of border units where borders of different color, texture or pattern indicated.
4. Include min. 6" long samples of each type of required accessory item such as wood or metal channels and feature strips, reducer strips, baseboard, trim molding and nosings.
5. Interior standing and running trim 2'-0" long x full width, unfinished.
6. Submit one finished wood floor sample, 1'-0" x 1'-0", for Architect's approval.
7. Wood Base and Trim; 1'-0" section.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood Flooring: Equal to 1 percent of amount installed for each type, color, and finish of wood flooring indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Specialized wood flooring firm with not less than 3 years successful experience in installation of flooring types specified.

B. Source Quality Control: Obtain flooring of each type from single manufacturer or source, to ensure match of quality, color, pattern and texture.

C. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.

D. Woodworking Standard: Where indicated for specific product comply with specified provision of following:

1. Architectural Woodwork Institute (AWI) "Quality Standards."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Moisture Content: At time of delivery, limit average moisture content of wood flooring to 12%, with 14% max. for any piece.

B. Protect wood flooring from excessive moisture in shipment, storage, and handling.

C. Deliver in unopened cartons or bundles and store in dry place, with adequate air circulation.

1. Do not deliver material to building until "wet work" such as concrete and plaster completed and cured to condition of equilibrium.

1.7 FIELD CONDITIONS

A. Conditioning:

1. Do not proceed with installation of wood flooring until spaces enclosed and at approximate humidity condition planned for occupancy.
2. Condition wood for 7 days prior to start of installation by placing in spaces to receive flooring.
3. Open packages of sealed wood flooring (if any) to permit natural adjustment of moisture content.
4. Upon delivery of wood to site, set up temporary (Hobo) thermostat record temperature and humidity 24/7 at 1 minute intervals, leave device in place until finial completion (Owner occupancy, make available date to Architect.)

B. Unless the following conditions can be maintained without permanent heating and cooling system in operation for a week before during installation and until project completion do not install flooring.

1. Maintain ambient temperature between 65ºF and 78ºF. Before, during, and after installation.
2. Maintain humidity conditions that approximate the humidity conditions, which will prevail when the building is occupied.
3. Relative humidity during sustained heating periods must not fall below 35 percent, provide humidification.
4. Relative humidity increases to 50 percent or higher take measures to dehumidify.

C. Cast in place concrete floors

1. Coordinate construction schedule with all environmental conditions to allow the concrete to cure to meet the moisture requirements of each floor finish.
2. Temporary dry in, accelerated drying equipment and reclaiming work is part of this project and shall not be considered a change order.
3. Removal of excess moisture: It is the responsibility of the contractor to place the concrete slab at the specified water/cement ration, properly cure concrete slabs, limit exposure to moisture, dry-in the building in a timely fashion and render the building HVAC system operational in sufficient time to allow for the concrete slabs to dry sufficiently to allow for the application of the flooring.

    a. Should the concrete slab fail to meet the established maximum limits for moisture, the contractor shall be responsible for the implementation of necessary procedures to dry out the slab.
    b. Contractor-CM responsible to cost for material, labor, and/or equipment required to dry out building sufficiently for installation of finished flooring systems.
    c. Contractor-CM responsible for remedial application (ARDEX) to provide an acceptable substrate for finish flooring. Remedial work is part of base bid and not considered a change order.

1.8 SPECIAL PROJECT WARRANTY

A. Submit 2 year warranty signed by Manufacturer, Installer, and Contractor, agreeing to repair or replace wood flooring which shrinks, warps, cracks, or otherwise deteriorates excessively, or which breaks anchorage or bond with substrate or otherwise fails to perform as required, due to failures of materials and/or workmanship and not due to unusual exposure to moisture or other abusive forces or elements not anticipated for application.

1.9 EXTRA STOCK/REPLACEMENT MATERIAL

A. After completion of wood flooring work, deliver to project site min. One (1) Gallon of floor finish New in unopened container.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General:

1. Nominal sizes indicated, except as shown by detailed dimensions.
2. Provide dressed or worked and dressed lumber, as applicable, manufactured to actual sizes required by PS 20 or to actual sizes and pattern shown, unless otherwise indicated.

B. Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having moisture content from time of manufacture until time of installation within ranges required in referenced woodworking standard.

C. Lumber for Transparent Finish (Stained or Clear): Use pieces made of solid lumber stock.

2.2 WOOD STRIP FLOORING SYSTEMS

A. System: Strip wood flooring fastened to plywood underlay and wood sleepers fastened to concrete floor.

1. Flooring Anchors: Steel pins, power driven.
2. Sleepers 2 x 4 Pressure treated Number 1 southern yellow pine kiln dried after treatment.
3. Plywood substrate on layer 3/4” BC plywood -APA Rated Exposure 1.
4. Subfloor Fasteners: 1-1/2” coated staples.
5. Finish face layer (MDO) Medium, Density overlay on marine plywood.
6. Solid wood trim Oak clear no knots.

B. Base: Clear, quarter sawn select and better white oak of size and shape shown on the Drawings. If not shown provide:

1. Base: Nom. 2 x 8, over 1/2" spacers, Notched for ventilation.
2. Top mold: Quarter round mold, 1-1/2".
3. Shoe mold: Quarter Round Mold, 3/4".

C. Wood Trim

1. Location, Stage apron, stage nosing and trim, stair treads, risers, base and skirt, stage base and other areas indicated on Drawings.
2. Species, Grade, and Cut: Provide following wood wherever strip type flooring indicated.
3. Comply with National Oak Flooring Manufacturers Association grading rules for species, grade, and cut.
4. Hard oak (red oak).

    a. Grade: second or better Clear no knots or checks.
    b. Cut: Plain Sawn.

2.3 ACCESSORY MATERIALS FOR WOOD FLOORING

A. Vapor Barrier: Minimum 6 mil polyethylene vapor barrier, black in color.

B. Underlayment: ASTM D 226, Type II, Asphalt saturated felt, non-perforated, 30# weight.

C. Adhesive/Mastic: Polyvinyl acetate or special mastic of type recommended by manufacturer of flooring, and complying with flammability and environmental control restrictions.

D. Fasteners: As recommended by manufacturer, but not less than recommended by NOFMA in "Installation Manual."

E. Wood Filler: Paste type wood filler, pigmented if necessary to match Architect's sample.

F. Wood Trim:

1. Where indicated to match wood flooring, provide wood base board molding, base shoe molding and stair risers.
2. Except as otherwise indicated, provide wood stripping, reducer strips, nosings, saddles and thresholds, as indicated in or adjacent to wood flooring.
3. Quarter Round Molding: 3/4” x 3/4” wood quarter round molding in species and finish to match wood flooring.
4. Threshold: 2" wide wood threshold molding, tapered each side and routed at bottom of one side to accommodate finish wood flooring; in species and finish to match wood flooring.
5. Transition Strip/Threshold: Recessed metal cover specified in Division 5 section.
6. Reducer Strip: 2" wide tapered reducer strip in thickness, species and finish to match wood flooring.

G. Floor Finish: Varnish flooring system Manufacturer's standard system to meet warranty requirements. As manufactured By, Bona-Kemi (Basis of Design) Advantage Coatings, Betco, Dura Seal.

1. Floor Sealer: Bona Kemi Bona All Sport- Basis of design.
2. Floor Finish: Bona Kemi Bona All Sport Basis of design.
3. Paint Bona Kemi - all colors custom -Basis of design.
4. Wood Stain For "Compatible with Top coat finishes”, Color and depth of satin as selected by architect.

H. Floor Wax: Liquid, solvent-type, slip-resistant, FS P-W-158, Type I, Class2.

2.4 WOOD TREATMENT

A. Preservative treatment: Following basic fabrication provide 3-minute dip treatment of finish carpentry items indicated to receive preservative treatment in 5% solution of pentachlorophenol, with vehicle not interfering with finish application and producing min. effect on appearance.

1. Apply brush coat on surfaces cut after treatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect and Discard unsound, warped, bowed, or twisted materials, improperly treated or inadequately seasoned materials or if units too small to fabricate work with min. of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

B. Concrete subfloor and surrounding masonry walls shall be instrument checked by flooring Contractor for excessive moisture, hardness, levelness and overall suitability of substrate.

1. Discrepancies shall be reported to General Contractor for correction.

C. Examine substrates on which wood flooring installed and conditions under which work performed.

1. Do not proceed with work until unsatisfactory conditions corrected in manner acceptable to Installer.

D. Flooring Manufacturer and flooring Sub-Contractor shall notify the General Contractor in writing as to their acceptance of the concrete sub-floor before installing specified floor system.

1. The beginning of installation of flooring over the concrete slab shall be considered as flooring manufacturer's and flooring Contractor's acceptance of concrete slab for installation of stage floor.

E. Commencement of installation of stage wood flooring shall be considered as acceptance of conditions as being suitable for installation of stage wood floor system.

3.2 INSTALLATION

A. General: Comply with flooring manufacturer's instructions and recommendations, but not less than recommended by NOFMA in "Hardwood Flooring Installation Material" and by recommendations of America Parquet Flooring Association, Inc., as applicable to type flooring required.

B. Install work plumb, level, true and straight with no distortions.

1. Shim as required using concealed shims.
2. Install to tolerance of 1/8" in 8'-0" for plumb and level horizontal surfaces and with 1/16" max. offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Pattern: Comply with pattern or direction of pattern for laying wood flooring as indicated or, if not indicated, as directed by Architect.

E. Expansion Space:

1. Provide expansion space at walls and other obstructions and terminations of flooring, min. 1/2” unless otherwise indicated on drawings.
2. Unless fully concealed by trim, fill expansion space with flush cork expansion strip.
3. Nail shoe molding or other trim to baseboard, rather than to flooring.

F. System Installation:

1. Vapor Barrier:

a. After substrate found acceptable for floor installation, install vapor barrier on face of concrete floor. Tape all joints in vapor barrier.

2. Sleepers:

a. Place 2 x 4 sleepers flat at 12" on center.
b. Notch underside of sleepers 3/4" x width of sleeper, at 24" on center for ventilation.
c. Fasten to concrete at 18” c/c with power actuated fasteners 2-1/4” long.

3. Glue and screw first layer of 3/4 inch plywood to 2 x 4 sleepers using #10s at 10” c/c.

a. Install plywood with grain of faces at right angles to sleeper.
b. Leave 1/8" space between edges of plywood.

4. Building Paper:

a. Install building paper on top of first layer of plywood.

5. Install second layer of plywood (MDO) over first layer of plywood. Off set joints to face layer plywood Screw in place, drill and counter sink. Fill each screw head with filler sand smooth.

a. Install stage flooring using mechanical fasteners as recommended by the stage flooring manufacturer.
b. Leave minimum of 1" expansion joint where flooring abuts walls or concrete slab. Provide expansion joint to suit temperature wood moisture and ambient.
c. Flooring shall be straight, true, level and square and free of squeak.
d. Install and anchor 14" to 16" o.c. with fasteners.

6. Stage Base:

a. At perimeter of stage provide ventilating wood base.
b. Base to be of sufficient size to cover expansion joint.
c. Install in a manner to promote ventilation of area below floor.

7. Stage Nosing/Trim:

a. At stage front omit 2" section of wood shims at 24" on center.
b. Ventilation shall be in the vertical plane, concealed from normal viewing angles.

8. Stage apron, nosing and trim:

a. Minimum width of nosing to be: 4".
b. Round top and bottom of exposed edges.
c. Install using continuous adhesive and mechanical fasteners (nails).

G. Base and stage front Trim:

1. Install with min. number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Stagger joints in adjacent and related members.

3. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.

H. Anchor trim to anchorage devices or blocking built-in or directly attached to substrates.

1. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation.
2. Except where prefinished matching fasteners heads required, use fine finishing nail for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent indicated.

3.3 SANDING AND FINISHING

A. Machine sand installed unfinished flooring to remove offsets and non level conditions, ridges, cups, and sanding machine marks visually noticeable after finishing.

1. Use 3 grades of sandpaper, ending with 00 grade.
2. Vacuum clean and immediately apply finish.
3. Do not permit traffic on floor after sanding and until finish completed.
4. Cover sanded floor with building paper to provide access for application of first finish coats.

B. Apply wood filler by brush, followed by wiping across grain to work into pores and cracks.

C. Apply stain to match approved sample.

D. Apply urethane finish, in accordance with manufacturer’s instructions.

1. First coat may be sealed as sealer or, at Installer’s option, first coat may be shellac sealer.
2. Apply as many coats (min. 3) as needed to build dry film thickness of 3.0 mils.
3. Retain empty containers for confirmation of film thickness.

E. Wax and buff completed finish before permitting traffic.

F. Color Selection:

1. Oak steps and trim, nosing at platform clear, transparent finish.
2. Platform surface and base 3 coats flat black paint.

3.4 PROTECTION

A. Protect completed wood flooring during remainder of construction period with heavy Kraft paper or other suitable covering, so that flooring and finish without damage or deterioration at time of Final Acceptance.

3.5 CLOSEOUT PROCEDURES

A. Provide services of Installers technical representative, and manufacturer's technical representative where required, to instruct Owner's personnel in operation and maintenance of wood flooring.

B. Schedule training with Owner, provide at least 7-day notice to Contractor and Architect/Engineer of training date.

C. Provide instructional video tapes for Owner's permanent library describing operation and maintenance of wood flooring.

END OF SECTION 09 6400

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.
2. Rubber stair accessories.
3. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 85 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexco; Roppe Holding Company.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation; Roppe Holding Company.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style B, Cove: Provide in areas with resilient floor coverings with toe.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length, no cut lengths.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Finish: Low luster.

I. Colors: As selected by Architect from full range of industry colors.

2.2 RUBBER STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allstate Rubber Corp.
2. American Biltrite.
3. Armstrong World Industries, Inc.
4. Burke Flooring.
5. Flexco; Roppe Holding Company.
6. Johnsonite; a Tarkett company.
7. Roppe Corporation; Roppe Holding Company.
8. Tarkett.
9. VPI Corporation.

C. Stair Treads: ASTM F2169.

1. Type: TS (rubber, vulcanized thermoset).
2. Class: 2 (pattern; embossed, grooved, or ribbed).
3. Group: 2 (with contrasting color for the visually impaired).
4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
5. Nosing Height: 1-1/2 inches.
6. Thickness: 1/4 inch and tapered to back edge.
7. Size: Lengths and depths to fit each stair tread in one piece.

D. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

E. Locations: Provide rubber stair accessories in areas indicated.

F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Johnsonite; a Tarkett company.
2. Roppe Corporation; Roppe Holding Company.
3. VPI Corporation.

B. Description: Rubber cap for cove carpet, cap for cove resilient floor covering, carpet bar for tackless installations, carpet edge for glue-down applications nosing for carpet, nosing for resilient floor covering, reducer strip for resilient floor covering, joiner for tile and carpet, transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6519.13 – LUXURY VINYL TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Luxury Vinyl Tile (LVT), Planks.
2. Refer to Drawings and Finish Schedule for colors and patterns.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type resilient flooring and accessory.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification Purposes: Submit following samples of each type, color, and pattern of resilient flooring required, showing full-range of color and pattern variations.

1. For each type of product indicated, in manufacturer's standard-size samples.

D. Product Schedule: For floor tile.

E. Colors: Submit a minimum of three sets of the manufacturers full line of color line from which Owner/Architect may select. Do not submit any samples which are either discontinued or not available for selection.

1. Once color samples of all interior finishes have been received the Architect will select colors from those submitted.
2. The architect shall not be limited to the number of tile colors which may selected for use in each area or on the project. The selection of multiple colors shall be at no additional cost to the contract.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Submit manufacturer's warranties, installation instructions, and maintenance instructions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

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.

C. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive LVT.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.8 EXTRA STOCK

A. Furnish and deliver to Owner, maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

B. Tile Flooring: Furnish min. one box for each 50 boxes or fraction thereof, for each type, color, pattern and size installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE (LVT)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett North America; iD Latitude or a comparable product by one of the following:

1. Armstrong Flooring, Inc.
2. Mannington.
3. Mohawk Group (The); Mohawk Carpet, LLC.
4. Shaw Contract Group; a Berkshire Hathaway company.

B. Size: Plank 6” x 48”.

C. Color: As noted on Finish Schedule or as selected by Architect from full range of industry colors.

D. Characteristics & Technical Performance:

	Standard	Tarkett value
Classification	ASTM F1700	Class III, Type B (Solid Vinyl Floor)
Surface Treatment	-	Techtonic
Total Thickness	ASTM F386	0.120" (3.05 mm)
Wear Layer Thickness	ASTM F410	20 mil (0.51 mm)
Installation Method	-	Glue-Down
Pattern	-	Refer to the product page
Pattern Type	-	Modern Wood, Vintage Wood, Linear, Wood
Laying Direction	-	Mono/Herrg/
Format Type	-	Plank
Commercial Warranty	-	20 year limited
Flexibility	ASTM F137	PASS
Chemical Resistance	ASTM F925	PASSES
Static Load Limit	ASTM F970	250 psi, ≤ 0.005”
Heat Stability	ASTM F1514	$\Delta E \leq 8.0$
Light Stability	ASTM F1515	$\Delta E \leq 8.0$
Slip Resistance	ASTM D2047	SCOF ≥ 0.5
Squareness	ASTM F2055	PASS
Flammability	ASTM E648	Class 1 (≥ 0.45 W/cm²)
Residual Indentation	ASTM F1914	PASS

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated and approved by floor tile manufacturer for applications indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive flooring.

B. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by carpet manufacturer and adhesive materials manufacturer.

C. Verify that required floor-mounted utilities are in correct location.

3.2 FLOOR SLAB FLATNESS

A. Inspect floor slab for flatness. Unless otherwise required by flooring manufacturer, surface of concrete slab to be level to within 1/8" in 8'-0".

1. The surface of the floor shall be smooth, level, and free of ridges, depressions and other imperfections.

B. Where concrete floor slab is found to be unlevel, grind high areas and fill depressions in order to obtain a smooth stable surface for installation of finished flooring.

C. Use leveling and patching compounds recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in subfloors.

3.3 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.4 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning, maintaining and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Final cleaning: After owner move in this shall be performed after the items on the deficiency have been completed. After owner move and prior to students starting class.

1. Move owner’s furniture as needed and place back in original position.

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 6519.13

SECTION 09 6813 - TILE CARPETING

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. Modular carpet tile.
2. Broadloom Carpet.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.

9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes shown on Drawings.
2. 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. Comply with the Carpet and Rug Institute's CRI 104.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 MOISTURE TESTING

A. Manufacturer recommendations: The work of this Section to conform with recommendations and requirements of flooring manufacturer and work defined herein. Where a conflict in the requirements exist the more stringent of the requirements shall apply.

B. Moisture: Contractor to perform moisture tests of concrete floor slab to verify that moisture is within tolerances allowed by manufacturer. If moisture content exceeds allowable levels, contractor shall implement measures to remove moisture from slab.

1. Do not install flooring until moisture content is within manufacturer’s tolerances.
2. Contractor to provide results to Owner, Architect, and Installer prior to start in installation.

C. Testing Agency: Testing to be performed by qualified third party testing agency acceptable to Architect.

D. Environmental Conditions: The conditions of the space in which the testing is to be performed shall meet the following conditions for no less than 48 prior to and after the test is performed:

1. Temperature: 75 degrees F +/- 10 degrees.
2. Humidity: 50% relative humidity +/- 10%.

E. Testing Types: Testing shall be one of the types listed:

1. Calcium Chloride Testing, using standard manufacturer's test kits.
2. Relative Humidity (RH) testing using Wagner Rapid RH Probe.

F. Calcium Chloride Testing: Testing for moisture vapor emission rate (MEVR) shall be performed in accordance with above referenced, applicable ASTM standards and the following:

1. Removal concrete coatings including curing compound.
2. Commence test no sooner than 24 hours from the time the concrete curing compound was removed.
3. Test shall be run for no less then 84 hours.

G. Relative Humidity Testing: Perform tests in accordance with probe manufacturer written instructions.

1. Drill hold of diameter required by probe.
2. Insert probe into holes.
3. Test results available without 45 minutes.

H. Testing Frequency: Moisture testing shall be performed as required by flooring manufacturer, but no less than quantity indicated herein:

1. Three (3) tests for the first 1,000 sf.
2. One (1) test for each additional 1,000 sf.

I. Testing Reports: Copies of third party testing reports to be submitted to the architect, contractor and flooring contractor prior to the installation of the flooring.

J. Cast in place concrete floors

1. Coordinate construction schedule with all environmental conditions to allow the concrete to cure to meet the moisture requirements of each floor finish.
2. Temporary dry in, accelerated drying equipment and reclaiming work is part of this project and shall not be considered a change order.
3. Removal of excess moisture: It is the responsibility of the contractor to place the concrete slab at the specified water/cement ration, properly cure concrete slabs, limit exposure to moisture, dry-in the building in a timely fashion and render the building HVAC system operational in sufficient time to allow for the concrete slabs to dry sufficiently to allow for the application of the flooring.
4. Should the concrete slab fail to meet the established maximum limits for moisture, the contractor shall be responsible for the implementation of necessary procedures to dry out the slab.
5. Contractor –CM, responsible to cost for material, labor, and/or equipment required to dry out building sufficiently for installation of finished flooring systems.
6. Contractor- CM, responsible for remedial application (ARDEX) to provide an acceptable substrate for finish flooring. Remedial work is part of base bid and not considered a change order.

1.12 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.
g. Failures Include: Edge curling, color shift, adhesion to substrate, adhesive failure.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (C-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract Group; a Berkshire Hathaway company; Established Tile, Style Number 5T268 or a comparable product by one of the following:

1. J&J Invision; J&J Industries, Inc.
2. Mohawk Group (The); Mohawk Carpet, LLC.
3. Tarkett.

B. Color: As selected by Architect from manufacturer's full range.

C. Properties:

1. Product Type: Carpet Tile.
2. Collection: Assembly.
3. Style Number: 5T268.
4. Construction: Multi-Level Pattern Loop.
5. Fiber: Eco Solution Q Nylon.
6. Dye Method: 100% Solution Dyed.
7. Primary Backing: Synthetic.
8. Secondary Backing: Ecoworx Tile.
9. Protective Treatments: SSP Shaw Soil Protection.
10. Recommended Adhesive: Shaw 5000, Shaw 5100, Shaw 4151, LokDots, LokWorx, Shaw 3800 or Shaw 5036.
11. Product Size: 12 in x 48 in.
12. Area per Carton: 48 ft².
13. Pieces per Carton: 12 pcs.

14. Gauge: 1/12 in.
15. Stitches: 8.5 per in.
16. Finished Pile Thickness: 0.088 in.
17. Average Density 8182 oz/yd³.
18. Kilotex: 11.27.
19. Total Thickness: 0.240 in.
20. Tufted Weight: 20 oz/yd².

2.2 CARPET TILE (C-2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract Group; a Berkshire Hathaway company; Convene Tile, Style 5T269 or a comparable product by one of the following:

1. J&J Invision; J&J Industries, Inc.
2. Mohawk Group (The); Mohawk Carpet, LLC.
3. Tarkett.

B. Color: As selected by Architect from manufacturer's full range.

C. Properties:

1. Product Type: Carpet Tile.
2. Collection: Assembly.
3. Style Number: 5T269.
4. Construction: Multi-Level Pattern Loop.
5. Fiber: Eco Solution Q Nylon.
6. Dye: Method 100% Solution Dyed.
7. Primary Backing: Synthetic.
8. Secondary Backing: Ecoworx Tile.
9. Protective Treatments: SSP Shaw Soil Protection.
10. Recommended Adhesive: Shaw 5000, Shaw 5100, Shaw 4151, LokDots, LokWorx, Shaw 3800 or Shaw 5036.
11. Product Size: 12 in x 48 in.
12. Area per Carton: 48 ft².
13. Pieces per Carton: 12 pcs.
14. Gauge: 1/12 in.
15. Stitches: 8.5 per in.
16. Finished Pile Thickness: 0.092 in.
17. Average Density: 7826 oz/yd³.
18. Kilotex: 11.02.
19. Total Thickness: 0.250 in.
20. Tufted Weight: 20 oz/yd².

2.3 CARPET TILE (C-3) BROADLOOM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract Group; a Berkshire Hathaway company; Design Series V-36, Style Number 5A033 or a comparable product by one of the following:

1. J&J Invision; J&J Industries, Inc.
2. Mohawk Group (The); Mohawk Carpet, LLC.
3. Tarkett.

B. Color: As selected by Architect from manufacturer's full range.

C. Properties:

1. Product Type: Broadloom.
2. Style Number: 5A033.
3. Construction: Solid Cut.
4. Fiber: Nylon.
5. Dye Method: 100% Piece Dyed.
6. Primary Backing: Synthetic.
7. Secondary Backing: Classicbac.
8. Protective Treatments: SSP Shaw Soil Protection.
9. Recommended Adhesive: H1000, H1200, H3800 or H1036.
10. Product Size: 12 ft.
11. Gauge: 1/10 in.
12. Stitches: 10.0 per in.
13. Finished Pile Thickness: 0.220 in.
14. Average Density: 5891 oz/yd^3.
15. Kilotex: 9.33.
16. Total Thickness: 0.376 in.
17. Tufted Weight: 36 oz/yd^2.
18. Installation Pattern: Repeatnone.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesive shall be designed to accept 5 pounds of moisture as tested by calcium chloride method.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 3000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

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

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 6813

SECTION 09 8413 SOUND-ABSORBING WALL UNITS

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 shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:
   1. Sound-absorbing wall panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.
B. SAA: Sound Absorption Average.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For sound-absorbing wall units. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.
   1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.

C. Samples for Initial Selection: For each type of fabric facing from sound-absorbing wall unit manufacturer's full range.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Electrical outlets, switches, and thermostats.
   2. Items penetrating or covered by sound-absorbing wall units including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.

d. Alarms.
e. Sprinklers.
f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to sound-absorbing wall units.

B. Product Certificates: For each type of sound-absorbing wall unit, from manufacturer.

C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA

C. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and acoustical ceilings is

complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Do not install sound-absorbing wall units until permit power and heating ventilating is commissioned and used daily

C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to the following:
      a. Acoustical performance.
      b. Fabric sagging, distorting, or releasing from panel edge.
      c. Warping of core.

   2. Warranty Period: Two years from date of finial Completion.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

1. Basis-of-Design Product: Subject to compliance with requirements, provide AVL Systems, Inc.; Acoustech or comparable product by one of the following:

   a. Acoustical Panel Systems (APS, Inc.).
   b. Acoustical Solutions, Inc.
   c. Armstrong World Industries.
   d. Decoustics Limited; a Saint Gobain company.
   e. Golterman & Sabo.
   f. MBI Products Company, Inc.
   g. Sound Concepts Canada, Inc.
   h. Sound Management Group LLC.
   i. Tectum Inc.
   j. Wall Technology, Inc.; an Owens Corning company.
   k. Wenger Corporation.

B. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
   1. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.

2. Core: Manufacturer's standard glass-fiber board.
   a. Core-Face Layer: Manufacturer's standard trackable, impact-resistant, high-density board.

3. Edge Construction: Manufacturer's standard extruded-aluminum or zinc-coated, rolled-steel frame.
4. Corner Detail in Elevation: Square with continuous edge profile indicated.
5. Facing Material: As selected from manufactures full range of fabric's
6. Nominal Thickness: 2 inch.
7. Panel size As indicated on Drawings.

2.2 MATERIALS

A. Core Materials: Manufacturer's standard.
   1. Glass-Fiber Board: ASTM C 612, Type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft. unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

B. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.

C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
   1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.3 FABRICATION

A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
   1. Glass-Fiber Board Cores: Chemically harden core edges and areas of core where mounting devices are attached.

B. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

C. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
   1. Square Corners: Tailor corners.
   2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.

D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
   1. Thickness.
   2. Edge straightness.
   3. Overall length and width.

4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.

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

3.2 INSTALLATION

A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent units.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch.

B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 8413

SECTION 09 8436 - SOUND-ABSORBING CEILING UNITS

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 shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Curvilinear Sound diffuser-reflector ceiling panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include panel edge, core material, and mounting indicated.

B. Shop Drawings: For unit assembly and installation.

1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.

C. Samples for Verification: For the following products:

1. Panel Edge: 12-inch-long Sample(s) showing each edge profile, corner, and finish.
2. Core Material: 12-inch-square Sample at corner.
3. Mounting Devices: Full-size Samples.
4. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets.
2. Suspended ceiling components above ceiling units.
3. Structural members to which suspension devices will be attached.
4. Items penetrating or covered by units including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Alarms.
    e. Sprinklers.
    f. Access panels.

5. Show operation of hinged and sliding components covered by or adjacent to units.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include manufacturer's written cleaning and stain-removal instructions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Acoustical performance.
b. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain ceiling units specified in this Section and wall units specified in Section 09 8433 "Sound-Absorbing Wall Units" from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; 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: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.3 SOUND DIFFUSER - REFLECTOR CEILING UNITS

A. Sound-Diffuser-Reflector Ceiling Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.

1. Basis-of-Design Product: Subject to compliance with requirements, provide AVL Systems, Inc.; AcoustiShell ArcWood Diffuser/Reflector or comparable product by one of the following:

    a. Acoustical Panel Systems (APS, Inc.).
    b. Acoustical Solutions, Inc.
    c. Armstrong World Industries.
    d. Decoustics Limited; a Saint Gobain company.
    e. Golterman & Sabo.
    f. MBI Products Company, Inc.
    g. Sound Concepts Canada, Inc.
    h. Sound Management Group LLC.
    i. Tectum Inc.
    j. Wall Technology, Inc.; an Owens Corning company.
    k. Wenger Corporation.

2. Panel Shape: Radially curved flat panel.
3. Fasteners: Factory Installed Eyebolt Attachment Points for Ceiling Suspension.
4. Finish: PS White Oak to stained to match architect sample.
5. Edge: Square.
6. Panel Thickness: .875".
7. STC Rating: STC 50.
8. Panel Width: As indicated on Drawings.
9. Panel Height: As indicated on Drawings.

2.4 MATERIALS

A. Core Materials: Manufacturer's standard.

1. Fire Rated FRP or Fire Rated MDF.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Measure each area and establish layout of panels and joints of sizes indicated on Drawings within a given area.

C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.

3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

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

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch in 48 inches, noncumulative.

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 8436

SECTION 09 9000 – PAINTS AND COATINGS

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 DESCRIPTION OF WORK

A. Extent of painting work indicated on Drawings and Schedules, and herein specified.

B. Work includes painting and finishing of Interior and Exterior exposed items and surfaces throughout Project, except as otherwise indicated.

1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
2. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.

C. "Paint" used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

D. Surfaces to be Painted:

1. Except where natural finish of material specifically noted as surface not painted, paint exposed surfaces whether or not colors designated in "schedules".
2. Where items or surfaces not specifically mentioned, paint same as similar adjacent materials or areas.
3. If color or finish not designated, Architect will select from standard colors or finishes available.
4. Following categories of work not included as part of field-applied finish work.

a. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing specified for such items as (but not limited to) follows:

1) Acoustic materials.
2) Architectural woodwork and casework.
3) Wood Doors.
4) Finished mechanical and electrical equipment.
5) Light fixtures.
6) Switchgear and distribution cabinets.

b. Concealed Surfaces: Unless otherwise indicated, painting not required on surfaces such as follows:

1) Walls or ceilings in concealed areas.
2) Generally inaccessible areas.
3) Foundation spaces.
4) Furred areas.

c. Finished Metal Surfaces: Unless otherwise indicated, similar finished metal surfaces listed below do not require painting:

1) Anodized aluminum.
2) Stainless steel.
3) Chromium plate.

d. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as follows, do not require painting:

1) Valve and damper operators.
2) Linkages.
3) Sensing devices.
4) Motor and fan shafts.

5. Following categories of work included under other Sections.

a. Shop Primers: Unless otherwise specified, shop priming ferrous metal items included under various Sections for structural steel, metal fabrications, hollow metal work and similar items.
b. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop fabricated or factory-built mechanical and electrical equipment or accessories included under other Sections.

6. Mechanical and Electrical Work: Painting of mechanical and electrical work specified in Divisions 23 and 26, respectively.

E. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

F. Repair existing construction defaced/damaged as result of work under this Contract and provide new painting and finishing to restore existing back to original materials, color, texture, and uniformness to satisfaction of Owner.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work:

1. Review other Sections in which prime paints provided to ensure compatibility of total coatings system for various substrates.
2. Upon request from other trades, furnish information/characteristics of finish materials provided for use, to ensure use of compatible prime coats.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical information including Paint label analysis and application instructions for each material used.

B. Samples:

1. Prior to beginning work, Architect will furnish color chips for surfaces to be painted.
2. Use representative colors when preparing samples for review.
3. Submit samples for Architect's review of color and texture only.
4. Provide listing of material and application for each coat of each finish sample.

    a. On 12" x 12" hardboard, provide two samples of each color and material, with texture to simulate actual conditions; resubmit samples requested by Architect until acceptable sheen, color, and texture achieved.
    b. On actual wood surfaces, provide two 4" x 8" samples of natural and stained wood finish; label and identify each location and application.
    c. On concrete masonry, provide two 4" square samples of masonry for each type of finish and color, defining filler, prime and finish coat.
    d. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples.

        1) Provide full-coat finish samples on min. 100 sq. ft. of surface, as directed, until required sheen, color and texture obtained.
        2) Simulate finished lighting conditions for review of in-place work.

5. Final acceptance of colors from samples applied on job.

1.5 DELIVERY AND STORAGE

A. Deliver materials to site in original, new and unopened packages and containers bearing manufacturer's label and following information:

1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer's stock number and date of manufacture.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.
9. Drying Time.
10. Clean up requirements.
11. Instructions for mixing.

B. Store materials not in actual use in tightly covered containers.

1. Maintain containers used for storage of paint in clean condition, free of foreign materials and residue.
2. Protect from freezing where necessary.
3. Keep storage area neat and orderly.
4. Remove oily rags and waste daily.
5. Take all precautions to ensure that workmen and work areas adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.6 COLOR SELECTION

A. Architect will select colors from manufacturer's standard or custom formulations for shades and tints required.

1. Deep colors/hues shall be used on accent walls, stripes or graphics. Modify paint formulation as required to accept deep colors without separation, streaking or other surface imperfections.

B. Individual elements may require change of hue or color at the discretion of Architect, without added cost to the contract. Individual element shall be defined as:

1. Each different building element, to include but not strictly limited to, walls, columns, frames, doors, windows, wall and ceiling furrings, columns, purlins, girts, beams, joists and decking.
2. Each change of building material within a space.
3. Changes of level or plane of like or similar materials within a space.

C. Accent Walls: Interior public or functional spaces shall have one or more walls as an "accent wall". For the purpose of this section the following spaces shall be considered as interior public and functional spaces: Lobbies, Commons, Corridors, Offices, Classrooms, Media Center, Gymnasium, and Lunchroom/Cafeteria and other similar spaces normally accessible to the students, staff and/or public.

1. Accent walls defined as change in color, tint or hue from that of other walls.
2. Cut corners or other locations where change between colors occur, straight, true and even.

D. Accent Stripes: Interior public or functional spaces shall be painted with accent stripes. For the purpose of this section the following spaces shall be considered as interior public and functional spaces: Lobbies, Commons, Corridors, Offices, Classrooms, Media Center, Gymnasium, Toilet Batteries, Dressing Rooms, Weight Rooms and Lunchroom/Cafeteria.

1. Horizontal stripes continuous for the length of Corridors, interrupted only by openings.
2. Color and layout of stripes to be determined during the shop drawings phase.
3. For bidding purposes the contractor shall assume that where stripes are to be painted that three stripes will be required. Each stripe to be 8" to 12" wide. Each stripe to be a different color.

E. Accent Graphics:

1. Graphic designs, consisting of rectilinear patterns and/or striping to be provided in lobbies, corridors, lunchrooms, cafetorium, gymnasium, multi-purpose rooms, and media center facility.
2. Design graphics for selected locations, size and design established by Architect at time of color selection, min of three, 500 s.f. each.
3. At each corridor and common area, provide a 3-color pattern that will repeat itself the full length of each (all) walls. Graphics size is approximately 4' x 6'.
4. Within Gym provide lower wainscot along with a graphics pattern of 5 colors, Pattern may not be horizontal or vertical.

F. Furred Gypsum Board Walls (Soffits)

1. Generally it is the intent that high furred gypsum board walls be painted a color different than the primary wall color. Deep hue accent colors will be used in these locations.

G. A total of twenty (20) colors may be chosen in addition to patterns above.

1. Office accent walls.
2. Trim accent colors.

1.7 EXTRA MATERIALS

A. Deliver extra materials to Owner.

B. Furnish Owner list of all colors utilized on project along with manufacturer's name, product name and, if custom color, formulation.

C. Furnish extra materials consisting of one full gallon of each paint product listed in paint schedule and utilized in Project, with lids sealed tightly for storage and identified with appropriate labels matching list of colors required above and including application instructions.

1.8 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50ºF (10ºC) and 90ºF (32ºC), unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces painted and surrounding air temperatures are between 45ºF (7ºC) and 95ºF (35ºC), unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.

1. Painting may be continued during inclement weather if areas and surfaces to be painted enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. Prior to commencing of painting contractor shall arrange to have tests of masonry performed to verify that moisture content is within manufacturers allowable ranges. DO NOT proceed with painting until moisture level is within the acceptable range.

1. Contractor to pay for cost of testing.

E. Painting of interior of building, including application of block filler, shall not begin until the following activities have been completed:

1. Partitions have been laid, pointed-up and rubbed-down to form a smooth uniform surface.
2. Roof system has been completely installed, including flashing and other components to ensure that building is water tight.
3. Openings in exterior envelope of building enclosed and sealed.
4. Moisture content of surface being painted is within allowable ranges.
5. Other preparation activities have been completed.

1.9 FIRE CODE REQUIREMENTS

A. Corridor partitions, smoke partitions, fire walls, area separation partitions, horizontal exit partitions, exit enclosures, and other fire partitions and ceiling fire rated assemblies and other areas as required by Fire Marshal (state and local) having jurisdiction, shall be effectively and permanently identified with signs or stenciling in manner acceptable to such authority.

B. Paint such identification above decorative ceiling in concealed spaces and in mechanical rooms.

C. Frequency of signage shall be as required by the Fire Marshal, but shall be no greater than 10’-0” on center for full length of wall. Min. height 4 inches.

D. Identification shall occur on both sides of partitions.

E. Identification shall occur on exposed side of fire rated assemblies. Suggested Wording:

1. Smoke Partition: “Smoke Barrier - Protect All Openings.”

a. 0.5 Hour Partition: “Smoke and 0.5 Hour Fire Barrier - Protect All Openings.”
b. 1.0 Hour Partition: “Smoke and 1.0 Hour Fire Barrier - Protect All Openings.”
c. 1.5 Hour Partition: “Smoke and 1.5 Hour Fire Barrier - Protect All Openings.”
d. 2.0 Hour Partition: “Smoke and 2.0 Hour Fire Barrier - Protect All Openings.”
e. 4.0 Hour Partition: “Smoke and 4.0 Hour Fire Barrier - Protect All Openings.”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.

3. Kelly-Moore Paint Company Inc., Devoe Coatings.
4. PPG Paints.
5. Sherwin-Williams Company (The).

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 MATERIALS

A. Material Quality:

1. Provide best quality grade of various types of coatings regularly manufactured by acceptable paint materials manufacturers.
2. Materials not displaying manufacturer's identification as standard, best-grade product not acceptable.

B. Proprietary names used to designate color or materials not intended to imply that products of named manufacturers required to exclusion of equivalent products of other manufacturers.

C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

D. Lead content in pigment limited to contain not more than 0.06% lead, as lead metal based on total non-volatile (dry-film) of paint by weight.

1. Limitation extended to interior surfaces and exterior surfaces, such as stairs, decks, porches, railings, windows, and doors readily accessible to children under seven years of age.

PART 3 - EXECUTION

3.1 INSPECTION

A. Applicator examine areas and conditions under which painting work applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work.

1. Do not proceed with work until unsatisfactory conditions corrected in manner acceptable to Applicator.
2. Starting of painting work construed as Applicator's acceptance of surfaces and conditions within any particular area.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of durable paint film.

3.2 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and herein specified, for each particular substrate condition.

1. Provide barrier coats over incompatible primers or remove and reprime as required; notify Architect in writing of any anticipated problems in using specified coating systems with substrates primed by others.
2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations.

    a. Remove, if necessary, for complete painting of items and adjacent surfaces.
    b. Following completion of painting of each space or area, reinstall removed items.

3. Clean surfaces to be painted before applying paint or surface treatments.

    a. Remove oil and grease prior to mechanical cleaning.
    b. Program cleaning and painting so contaminants from cleaning process will not fall on wet, newly-painted surfaces.

B. Cementitious Materials:

1. Prepare cementitious surfaces of concrete, concrete block, cement plaster and mineral-fiber-reinforced cement panels for paint by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
2. Tooling, Pointing and Patching: Work of this section shall not commence until tooling, pointing and patching of masonry work completed.
3. Determine alkalinity and moisture content of surfaces by performing appropriate tests
4. If surfaces found sufficiently alkaline to cause blistering and burning of finish paint, correct condition before application of paint.
5. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
6. Clean concrete floor surfaces scheduled with commercial solution or muriatic acid, or other etching cleaner before painting.
7. Flush floor with clean water to neutralize acid, and allow to dry before painting.

C. Wood:

1. Clean wood surfaces of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required.

    a. Sand smooth those finished surfaces exposed to view, and dust off.
    b. Scrape and clean small, dry, seasoned knots and apply thin coat of white shellac or other recommended knot sealer, before application of priming coat.
    c. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler.
    d. Sand smooth when dried.

2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job.

    a. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.
    b. When transparent finish required, use spar varnish for back-priming.
    c. Backprime paneling on interior partitions only where masonry, plaster, or other wet wall construction occurs on backside.

d. Seal tops, bottoms, and cut-outs of unprimed wood doors with heavy coat of varnish or equivalent sealer immediately upon delivery to job.

D. Ferrous Metals:

1. Clean ferrous surfaces not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
2. Touch-up shop-applied prime coats wherever damaged or bare, where required by other Sections; clean and touch-up with same type shop primer.

E. Galvanized Surfaces:

1. Clean free of oil and surface contaminants with non-petroleum based solvent.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

1. Tinting of paint shall be done by paint supplier.
2. Materials shall not be modified in any manner on the job.
3. All materials to arrive on job site in original, factory labeled containers.

B. Maintain containers used in mixing and application of paint in clean condition, free of foreign materials and residue.

C. Stir materials before application to produce mixture of uniform density, and stir as required during application.

1. Do not stir surface film into material.
2. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

A. General:

1. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.

a. Paint colors, surface treatments, and finishes, indicated in "schedules" of Contract Documents.
b. Block filler shall be applied to cover all CMU voids. Do not add any thinners/cutting agents. Apply product to hide gray of CMU more than 1 coat may be required.
c. Provide finish coats compatible with prime paints used.

2. Apply paint using applicators and techniques best suited for substrate and type of material being applied.

a. Apply paint using brush or roller only.
b. Paint applied to hollow metal frames to be applied with paint brush only.

c. Use of spray application acceptable only in areas where not accessible by brush or roller. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.

3. Apply first finish coat with light tint of second finish coat color.

   a. First finish coat must contrast with prime coat and second finish coat to identify it as such.

4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.

   a. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.

5. Paint exposed ductwork.
6. Field paint factory primed HVAC grilles and registers.
7. Paint interior surfaces of ducts, where visible through registers or grilles, with flat, non-specular black paint.
8. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
9. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.
10. Sand lightly between each succeeding enamel or varnish coat.
11. Omit first coat (primer) on shop primed metal surfaces and touch-up painted, unless otherwise indicated.
12. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film of uniform finish, color and appearance.

    a. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
    b. Provide additional coats of paint required for adequate coverage and complete coverage where deep tints/hues selected.

B. Painting of Areas Previously Painted: Where portions of the building previously painted indicated to be painted as part of this contract, the contractor shall repaint in accordance with provisions of this section. Provide a min. of three coats of paint as follows:

1. Primer: Provide primer of type recommended by manufacturer.
2. First Finished Coat: Provide first finished coat of type specified.
3. Second Finished Coat: Provide second finished coat of type specified.
4. Additional Finished Coat: Provide additional coats of paint necessary for coverage.

C. Scheduling Painting:

1. Apply first-coat material to surfaces cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying.
3. Do not recoat until paint dried so it feels firm, and does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of undercoat.

D. Minimum Coating Thickness:

1. Apply materials at not less than manufacturer's recommended spreading rate, to establish total dry film thickness indicated or, if not indicated, recommended by coating manufacturer.

E. Doors and Frames: Field apply painters finish to doors and frames unless pre-finished. Where painters finish applied the following conditions shall be met:

1. Remove all rust and other surface imperfections by sanding.
2. Repair doors and frames where damaged through installation or subsequent construction activities.
3. Lightly sand surface prior to painting and between each coat to obtain a smooth uniform texture.
4. Field paint all surfaces of doors and frames.

    a. In areas not scheduled to be painted, paint both sides of doors and frames.
    b. Finish doors on tops, bottoms and side edges same as faces, unless otherwise indicated.

5. Apply paint using brush or spray application methods. Use of a roller or other methods resulting in a textured surface not acceptable.
6. Finished surface shall be smooth in texture and free from brush marks.

F. Exterior Items to be Painted Include, but are not limited to:

1. Items identified in this Section, elsewhere in these specifications, and on the Drawings.
2. Ferrous metals which are not specified to have factory applied finish coat.
3. Types of ferrous metals to be painted, include but not limited to:

    a. Pipe Bollards.
    b. Downspout boots.
    c. Trench Drains and Sand Traps.
    d. Storm Drainage inlets, manhole covers and rings, etc.
    e. Steel Lintels, miscellaneous steel and exposed structural steel.
    f. Hollow metal doors, windows, and frames.

G. Mechanical and Electrical Work:

1. Limit painting of mechanical and electrical work to; unless specifically noted otherwise:

    a. Items exposed in occupied and non-occupied areas.
    b. Items exposed in mechanical and electrical rooms, whether room is scheduled to be painted or not.
    c. Items exposed at exterior of building.

2. Paint Mechanical (Plumbing and HVAC) items including, but not limited to, following:

    a. Building sprinkler system piping. (Refer to Division 21)
    b. Exposed insulation on HVAC system piping.
    c. Piping, pipe hangers, and supports, exposed plumbing vent stacks.

d. Heat exchangers.
e. Tanks.
f. Ductwork, insulation.
g. Motor, mechanical equipment, and supports.
h. Accessory items.
i. Items addressed in mechanical drawings and specification.

3. Paint electrical items including, but not limited to, following:

a. Conduit and fittings.
b. Switchgear.
c. Disconnects.
d. Items addressed in electrical drawings and specification.

H. Prime Coats:

1. Apply prime coat to material required to be painted or finished, and not prime coated by others.
2. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat, to assure finish coat with no burn through or other defects due to insufficient sealing.
3. Concrete Block, Concrete and Cementitious Roof Deck:

a. Prime coat (block filler) on porous surfaces shall be spray applied and subsequently rolled.
b. Apply block filler in number of coats necessary and of thickness required to fill all pores and to fully conceal the natural color of the substrate.
c. Re-apply prime coat as necessary until natural color of substrate is no longer visible.
d. Re-apply prime coat until pores of substrate fully filled.
e. The color of the substrate shall be pure white (no grey bleed through) and the pores shall be filled prior to the application of finished coats of paint.
f. Finished coats shall not be applied until Architect has approved primer application.

I. Pigmented (Opaque) Finishes:

1. Completely cover to provide opaque, smooth surface of uniform finish, color, appearance and coverage.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections not acceptable.

J. Transparent (Clear) Finish:

1. Use multiple coats to produce glass-smooth surface film of even luster.
2. Provide finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
3. Provide satin finish for final coats, unless otherwise indicated.

K. Completed Work:

1. Match approved samples for color, texture and coverage.
2. Remove, refinish or repaint work not in compliance with specified requirements

3.5 FIELD QUALITY CONTROL

A. Owner reserves right to invoke following material testing procedure at any time, and any number of times during field painting:

1. Engage services of an independent testing laboratory to sample paint being used.
2. Samples of materials delivered to project site taken, identified and sealed, and certified in presence of Contractor.
3. Testing laboratory perform appropriate tests for any or all of following characteristics:

    a. Abrasion resistance.
    b. Adhesion.
    c. Apparent reflectivity.
    d. Flexibility.
    e. Washability.
    f. Absorption.
    g. Accelerated weathering.
    h. Dry opacity.
    i. Accelerated yellowness.
    j. Recoating.
    k. Skinning.
    l. Color retention.
    m. Alkali resistance.
    n. Quantitative materials analysis.

B. If test results show material being used does not comply with specified requirements, Contractor directed to stop painting work, and:

1. Remove non-complying paint.
2. Pay for testing.
3. Repaint surfaces coated with rejected paint.
4. Remove rejected paint from previously painted surfaces if, upon repainting with specified paint, two coatings are non-compatible.

3.6 CLEAN-UP AND PROTECTION

A. Clean-Up:

1. As work Progresses, remove discarded paint materials, rubbish, cans and rags from site at end of each work day.
2. Upon completion of painting work, clean window glass and other paint spattered surfaces.
3. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection:

1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work.
2. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

3. Provide "Wet Paint" signs as required to protect newly-painted finishes.
4. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
5. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.7 MANUFACTURES ABBREVIATIONS

1. B-M: Benjamin Moore & Co.
2. H&C: H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.
3. K-M: Kelly-Moore Paint Company Inc., Devoe Coatings.
4. PPG: PPG Paints.
5. S-W: Sherwin-Williams Company (The).

3.8 EXTERIOR PAINTING SCHEDULE

A. General: Provide the following Paint systems for the various substrates, hollow metal doors and frames.

B. Ferrous Metal: Primer not required on shop-primed items.

1. Full Gloss Alkyd Enamel: 2 finish coats over primer.

a. Primer: Synthetic Rust-Inhibitive Primer.

1) S-W: Kem Kromik Universal Metal Primer, B50WZ1.
2) B-M: P06 Super Spec Alkyd Metal Primer.
3) PPG 6-208 Steel primer Speedhide Primer

b. First and Second Coats: Gloss Alkyd Enamel.

1) S-W: Pro Industrial Urethane Alkyd Enamel, B54W150.
2) B-M: P22 Super Spec HP Urethane Alkyd Gloss Enamel.
3) PPG: 7-282 Speed Hide Urethane modified Gloss Oil.

C. Exterior Latex:

1. Latex Satin Finish: 2 coats over filled surface with min. total dry film thickness of 3.5 mils, excluding filler coat.

a. Location: Exterior siding and trim.
b. Primer: Concrete and Masonry Primer.

1) S-W: Loxon Concrete & Masonry Primer/Sealer, LX02W50.
2) B-M: 608 Ultra Spec Masonry Interior/Exterior 100% Acrylic Sealer.
3) PPG: 4-603 XI Prema-Crete Alkali Resistant Primer.

c. First and Second Finish Coat: Exterior, Satin, 100% acrylic.

1) S-W: A-100 Exterior Latex Satin, A82 Series.
2) B-M: N455 Ultra Spec EXT Low Lustre.

3) PPG: Sunproof Satin 76-110XI.

D. Exterior Concrete Masonry Units:

1. Acrylic Satin/ Low Lustre Finish: 2 coats over filled surface.

a. Location: Exterior New CMU.
b. Primer: Latex block filler.

1) S-W: S-W PrepRite Int/Ext Latex Block Filler, B25W25.
2) B-M: Benjamin Moore Ultra Spec Masonry High Build Block Filler Flat 571.
3) PPG: Speedhide 6-15 Interior/Exterior Hi Fill Acrylic Block Filler.

c. First and Second Finish Coat: Exterior, acrylic latex low lustre finish, acrylic.

1) S-W: S-W Duration Exterior Acrylic Satin, K33 Series.
2) B-M: Benjamin Moore Ultra Spec EXT Low Lustre N455.
3) PPG: Acri-Shield Max 739-10 Exterior Premium Latex Satin paint.

3.9 INTERIOR PAINTING SCHEDULE

A. Abbreviations:

1. PCB - Painted Concrete Block.
2. EPCB - Epoxy Painted Concrete Block.
3. PGB - Painted Gypsum Board.
4. ESP - Exposed Structure Painted.
5. WFB - Wood Fiber Board.
6. PVFI - Painted Vinyl Faced Insulation.
7. CONC - Concrete.
8. CONC-ST - Concrete Stained.

B. General: Provide the following paint systems for the various substrates, as indicated.

C. Concrete Masonry Units:

1. Eggshell Enamel Finish: 2 coats over filled surface. Void of any Pinholes upon completion.

a. Location: All areas noted (PCB) Painted concrete Block.
b. Block Filler: Heavy Duty High-Performance Latex Block Filler. Apply filler coat at a rate to ensure complete coverage with pores filled.

1) S-W: Pro Industrial Heavy Duty Block Filler, B42W150.
2) B-M: 571 Ultra Spec Hi-Build Masonry Block Filler.
3) PPG: Speedhide 6-15XI.

c. First and Second Finish Coat: Interior, Eggshell, Pre-Catalyzed Water Borne Epoxy.

1) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45 Series.
2) B-M: V342 Corotech Pre-Catalyzed Waterborne Epoxy Eggshell.
3) PPG: 16-310 Pitt-Glaze Pre-Catalyzed Water based Epoxy WB1

2. Semi-Gloss Enamel Finish 2 coats over filled surface with min. total dry film thickness of 3.5 mils, excluding filler coat.

    a. Location: All areas noted (PCB) Painted Concrete Block.
    b. Block Filler: High-Performance Latex Block Filler. Apply filler coat at a rate to ensure complete coverage with pores filled.

        1) S-W: Pro Industrial Heavy Duty Block Filler, B42W150.
        2) B-M: 571 Ultra Spec Hi-Build Masonry Block Filler.
        3) PPG: Speedhide 6-15XI.

    c. First and Second Finish Coat: Interior, Semi-Gloss, Pre-Catalyzed Water Borne Epoxy.

        1) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss, K46 Series.
        2) B-M: V342 Corotech Pre-Catalyzed Waterborne Epoxy Eggshell.
        3) PPG: 16-510 Pitt-Glaze Pre-Catalyzed Water based Epoxy WB1

3. Gloss Epoxy Finish: Two coats over filled surface with min. 3.5 mils, excluding filler coat.

    a. Location: All areas noted (EPCB) Epoxy Painted Concrete Block.
    b. Block Filler: High-Performance Latex Block Filler Apply filler coat at a rate to ensure complete coverage with pores filled.

        1) S-W: Pro Industrial Heavy Duty Block Filler, B42W150.
        2) BM: 571 Ultra Spec Hi-Build Masonry Block Filler.
        3) PPG: Speedhide 6-15XI.

    c. First and Second Coat: Gloss Water Epoxy.

        1) S-W: S-W: Pro Industrial Waterbased Catalyzed Epoxy, B73-360.
        2) B-M: V440 Corotech Waterborne Amine Epoxy Gloss.
        3) PPG: 98E-1 Aquapon WB EP Water Based Gloss Epoxy.

D. Gypsum Drywall Systems:

1. Location: All areas noted (PGB) Painted Gypsum Board.
2. Eggshell Finish: 3 coats with min. total dry film thickness of 2.5 mils.

    a. Primer: White, Interior, Water Based Primer.

        1) S-W: ProMar 200 Zero-VOC Interior Latex Primer, B28W2600.
        2) B-M: N534 Ultra Spec 500 Interior Latex Primer.
        3) PPG: Seal Grip 17-921XI.

    b. First and Second Coats: Interior, Eggshell, Waterborne.

        1) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45 Series.
        2) B-M: N538 Ultra Spec 500 Interior Eggshell.
        3) PPG: 16-310 Pitt-Glaze Pre-Catalyzed Water based Epoxy WB1.

E. Alkyd Dryfall Paint System: Steel deck Modified Alkyd Interior where over spray dries with-in 10 feet. Bright white Solvent borne full hiding over steel deck.

1. Location: All areas noted (ESP) Exposed Structure Painted.
2. Flat Finish: 2 coats with min. total dry film thickness of 5.0 mils.

a. First and Second Coats: Interior, Flat

1) S-W: Alkyd Dryfall Flat, B48 Series.
2) B-M: 105 Coronado Super Kote 5000 Dry Fall Alkyd Flat.
3) PPG: 6-160xi Speed Hide Alkyd Dry Fog Flat.

F. Water Based Dryfall Paint System: Wood fiber desk Modified Water based Interior where over spray dries with-in 10 feet. Bright white Waterborne full hiding over Tectum deck.

1. Location: All areas noted Painted, (WFB) Wood Fiber Board.
2. Flat Finish: 3 coats with min. total dry film thickness of 5.0 mils.

a. First and Second Coats: Interior, Flat.

1) S-W: B42W181 pro Industrial Waterborne Acylic DryFall.
2) B-M: 395 Latex Dry Fall Flat; Or B-M N110 Coronado Super Kote 5000 Dry Fall Acrylic Latex Flat.
3) PPG: 90-812 Pitt-Tech Acrylic DryFall

G. Waterborne Acrylic Dryfall Paint System. Vinyl Faced Insulation Modified Water based Interior where over spray dries with-in 10 feet. Flat black Waterborne full hiding over Vinyl Faced Insulation.

1. Location: All areas noted (PVFI) Painted Vinyl Faced Insulation.
2. Flat Finish: 2 coats with min. total dry film thickness of 5.0 mils.

a. First and Second Coats: Interior, Flat.

1) S-W: S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42B00081.
2) B-M: Latex Dry Fall Flat 395-80 Black (1.4 – 2.6 mils dry film thickness).

H. Stained Woodwork:

1. Stained - Varnish Rubbed Finish: 3 finish coats over stain plus filler on open grain wood. Wipe filler before applying first varnish coat.

a. Location: All wood work not listed as paint or shipped Pre-Finished.
b. Stain Coat: Oil-Type Interior Wood Stain.

1) S-W: Minwax Performance Series Tintable Wood Stain.
2) B-M: 1AS.12XX Lenmar QuickStain Alkyd Wiping Stain.
3) PPG: Deft DFT 400 series

c. First Coat: Cut Shellac.
d. Filler Coat: Paste Wood Filler.
e. Second and Third Coats: Urethane Varnish.

1) S-W: Minwax Performance series Fast dry Varnish.
2) B-M: 1Y.915 Lenmar Polyurethane Wood Finish Dull Rubbed.
3) PPG: Deft DFT 127 Gloss, 128 SG, 129 Satin Polyurethane.

I. Ferrous Metal: Primer not required on shop-primed items.

1. All interior metal doors and frames and other metal items requiring paint.
2. Full Gloss Alkyd Enamel: 2 finish coats over primer.

a. Primer: Synthetic Rust-Inhibitive Primer.

1) S-W: Kem Kromik Universal Metal Primer, B50WZ1.
2) B-M: P06 Super Spec Alkyd Metal Prime.
3) PPG: 6-208 Steel primer Speedhide Primer

b. First and Second Coats: Gloss Alkyd Enamel.

1) S-W: Pro Industrial Urethane Alkyd Enamel, B54W150.
2) B-M: P22 Super Spec HP Urethane Alkyd Gloss Enamel.
3) PPG: Glyptex 4139-10 Gloss.

J. Zinc-Coated Metal: Primer not required on shop-primed items.

1. High Gloss Alkyd Enamel: 2 finish coats over primer.

a. Primer: Galvanized Metal Primer.

1) S-W: B66W310 Pro Industrial Pro-Cryl Universal primer.
2) B-M: HP04 Ultra Spec HP Acrylic Metal Primer.
3) PPG: 4020PF Pitt-Tech Plus

2. First and Second Coats: Gloss Alkyd Enamel.

1) S-W: B-54-150 Pro Industrial Urethane Alkyd Enamel.
2) B-M: P22 Super Spec HP Urethane Alkyd Gloss Enamel.
3) PPG: Glyptex 4139-10 Gloss.

K. Zinc-Coated Metal: Interior Hollow Metal Toilet Doors.

1. High Gloss Alkyd Enamel: 2 finish coats over primer.

a. Primer: Galvanized Metal Primer.

1) S-W: Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series.
2) B-M: Corotech Acrylic Metal Primer, V110.
3) PPG: Pitt Tech Plus Primer 4020PF.

2. First and Second Coats: Waterbased Alkyd Urethane Enamel.

1) S-W: Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series.

2) B-M: Corotech Alkyd Urethane Enamel Semi-Gloss, V201 or Corotech Alkyd Urethane Enamel Gloss, V200.
3) PPG: Speedhide WB Alkyd 6-1610XI Gloss, Speedhide WB Alkyd 6-1510XI SG.

L. Concrete Flooring Water-Based Solid Color Concrete Stain. 2 coats minimum.

1. Location: All floors listed as (CONC) Concrete, (CONC-ST) Concrete Stained.
2. Penetrating Stain Finish:

a. Finish Coats: Multi-Purpose Floor coating.

1) H&C: Colortop Water-Based Solid Color Concrete Stain.
2) B-M: CST-2XXX Insl-X TuffCrete WB Acrylic Waterproofing Concrete Stain.
3) PPG: PPG Perma Crete Color Seal 4-4210XI.

b. Slip Resistance:

1) H&C: SharkGrip Slip Resistant Additive.
2) B-M: Corotech Anti-Slip Aggregate V630.

M. Concrete Flooring Water Based Epoxy Systems. 2 coats with min. total dry film thickness of 5.0 mils.

1. Location: Auditorium, under seating.
2. Water based epoxy floor coating.

1) S-W: Armorseal 8100 Water Based Epoxy Floor Coating, B70-8100 Series.
2) B-M:

a) (1 coat) Primer: Benjamin Moore Corotech 100% Solids Epoxy Pre-Primer V155 (2.0 – 3.2 mils wet/dry film thickness)
b) (2 coats) Topcoats: Benjamin Moore Corotech Waterborne Amine Epoxy V440 (1.5 – 1.9 mils dry film thickness)

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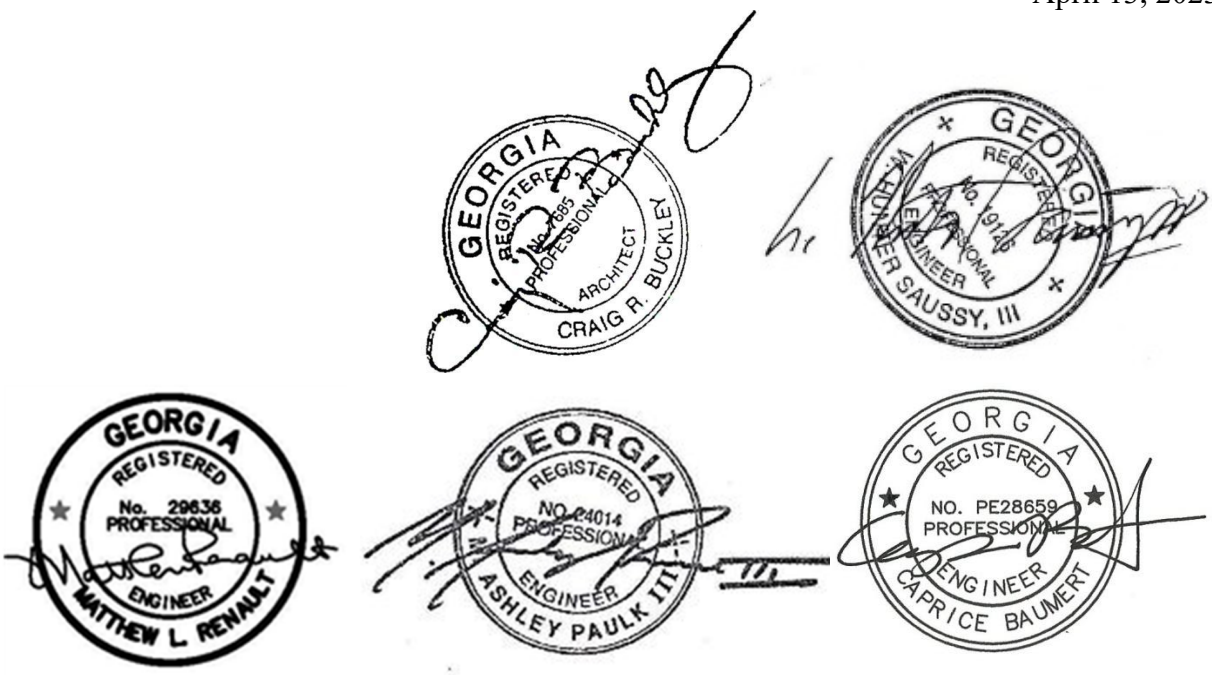
Project No. 21-036
Bid Set

Set No.

Strickland Arts and Cultural Center
Evans County, Georgia

Volume II of II

April 13, 2023



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Evans County, Georgia

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Project No. 21-036

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Evans County, Georgia

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SECTION 10 1423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

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 room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Include plans, elevations, and large scale details of sign wording and lettering layout.
4. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
5. Submit min. four (4) copies of complete list itemizing all rooms showing room name and number, including disabled accessibility signs.

    a. Indicate door number where sign located or other identifying designation.
    b. Indicated number of lines and size of sign required for text required.
    c. Utilize room names and numbers shown on drawings for initial submittal.
    d. After review of initial submittal by Architect and Owner, submit final list for review and approval.

C. Samples: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics.
2. Submit full-size sample units.
3. Acceptable units may be installed as part of Work.

D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Variable Component Materials: 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.
2. Tools: One set(s) of specialty tools for assembling signs and replacing variable sign components.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

B. Uniformity of Manufacturer: For each sign form and graphic image process indicated, furnish products of single manufacturer.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

B. Disability Compliance: Meet requirements of Georgia Code Chapter 120-3-20 "Accessibility Code for Buildings and Facilities".

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ASI Sign Systems, Inc.
    b. Best Sign Systems, Inc.
    c. Inpro Corporation.
    d. Mohawk Sign Systems.
    e. Poblocki Sign Company, LLC.
    f. Seton Identification Products; a Brady Corporation company.
    g. Signature Signs, Inc.
    h. Whitfield Sign Company.

2. Laminated-Sheet Sign: Photopolymer or Sandblasted polymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.

    a. Composite-Sheet Thickness: 0.125 inch (1/8 inch).

2.3 PANEL SIGNS, ROOM SIGNS

A. Fabricate panel signs to comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes and details of construction.

B. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed condition within tolerance of +1/16" measured diagonally.

C. Unframed Panel Signs: Fabricate unframed panel signs with edges mechanically and smoothly finished to conform with following requirements:

1. Edge Condition: Square cut.
2. Edge Color for Plastic Laminate: Same as background.
3. Corner Condition: Rounded to radius indicated.

D. Provide a back plate for any sign applied to a glass or transparent surface, back plate to be the same color, shape and size as the sign. Apply back plate to opposite side of the glass or transparent surface as signage.

E. Graphic Image Process:

1. Graphic Content and Style: Provide sign copy to comply with requirements indicated for sizes, styles, spacing, content, positions, materials, finishes and colors of letters, numbers, symbols and other graphic devices.
2. Pictograms:

    a. All pictograms based on international symbols and those developed by U.S. Department of Transportation.
    b. Accompany by verbal and braille description below pictogram.
    c. Required Pictograms:

        1) Accessibility Symbol.

    d. Pictogram plaques same as interior door plaques.
    e. Refer to drawing at end of this Section.

3. Characters: Meet ADA requirements for proportion of height and width and height and stroke width.

    a. Characters: "Helvetica" Medium C, all same height, minimum 1".
    b. Braille: Provide below characters.

4. Sign Size: Min. 6" x 6" but as required to maintain min. 1" between lettering and edge.
5. Sand-cut or Machine-cut Engraved Copy - Raised Characters:

    a. Sand-cut or machine-cut background to produce raised letters, numbers, symbols and other graphic devices on sign panel on face indicated to provide precisely formed copy, with background incised to uniform depth.
    b. If machine cut, use high speed cutters mechanically linked to master templates in pantographic system or equivalent process capable of producing characters of style indicated with sharply formed edges.
    c. Plastic Laminate: Cut through exposed face ply of plastic laminate sheet to expose contrasting core ply.
    d. Produce copy to provide min. indentation depth of 1/32" and min, stroke width of 1/4".

6. Name Slot:

    a. Window: Clear plastic over slot for insertion of plastic strip containing copy by Owner.

        1) Required only at Corridor or Passage door locations of staff occupied areas.
        2) Size: 1" clear height, 7/8" viewing height x width of sign.
        3) As indicated.
        4) Provide back-coated .020" thick rigid vinyl insert 1/6" less than height of slot x full width of slot.

5) Locate on sign as directed by Architect.

F. Copy Content:

1. Refer to Part 3 of this Section for locations.
2. Room Identification Signs:

a. Room name, characters and braille.
b. Room number, characters and braille.

3. Disabled Accessible Toilet Signs:

a. Accessibility symbol
b. Text "MEN", "WOMEN", "BOYS", "GIRLS" or "TOILET" as applicable, characters and braille.

2.4 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Fasteners: Unless otherwise indicated, concealed fasteners fabricated from metals non-corrosive to either sign material or mounting surface.

C. Anchors and Inserts:

1. Non-ferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance.
2. Toothed steel or lead expansion bolt devices for drilled-in-place anchors.
3. Inserts, as required, set into concrete or masonry work.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide

color matches indicated, or if not indicated, as selected by Architect from manufacturer's standards.

C. Field-Applied, Vinyl-Character Sign Pre-spaced characters die cut from 3 to 3.5-mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.3 LOCATIONS

A. Room Identification:

1. Provide one sign for every interior door location except disabled accessible toilets.
2. Install signs on wall at latch side of doors outside of space identified, centered 60" above finished floor.

B. Disabled Accessible Toilets:

1. Provide one sign for every battery or individual toilet room containing provisions for disabled.
2. Install signs on wall at push/pull or latch side of door outside of toilet, centered 60" above finished floor.

C. Exterior mechanical rooms provide die cut vinyl sign with 3” tall letters, White, (Apply to door).

END OF SECTION 10 1423.16

SECTION 10 2113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge(s) with associated fasteners.
2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: One door bumper(s) with associated fasteners.
4. Door Pull: One door pull(s) with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ampco by AJW.
2. ASI Accurate Partitions.
3. ASI Global Partitions.
4. Bobrick Washroom Equipment, Inc.
5. Bradley Corporation.
6. Knickerbocker Partition Corporation.

B. Toilet-Enclosure Style: Overhead braced, Floor anchored.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.

E. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

F. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

G. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
3. Edge Color: Through-color matching facing sheet color.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.
2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless steel bumper at out-swinging doors. Mount with through-bolts.
5. Door Pull: Manufacturer's heavy-duty cast-stainless steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.

a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 2113.17

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Toilet Accessories:

a. Mirrors (M).
b. Paper Towel Dispenser (PTD).
c. Toilet Tissue Dispenser (TTD).
d. Paper Towel Receptacle (PTR).
e. Soap Dispenser (SD).
f. Grab Bar (GB).
g. Electric Hand Dryer (EHD)

2. Miscellaneous Accessories:

a. Mop and Broom Holder (MBH).
b. Baby Changing Station (BCS)
c. Defibrillator (AED)

3. Bath and Shower Accessories:

a. Soap Tray (ST)
b. Towel Pin (TP)
c. Robe Hook (RH)
d. Shower Curtain Rod (SCR)
e. Shower Curtain and Hooks (SCH)
f. Folding Shower Seat (FS)

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: For each exposed product and for each finish specified, full size.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

D. Delegated Design Submittal: For grab bars and shower seats.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 500 lbf applied in any direction and at any point.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AJW Architectural Products.
2. American Specialties, Inc. (ASI).
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.

2.3 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch-minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

A. General:

1. No names labels permitted on exposed faces.
2. On interior surface not exposed to view or on back surface, identify item by printed, waterproof label or stamped nameplate with manufacturer's name, product model number.

B. Surface-Mounted Units, General:

1. Except where otherwise indicated, fabricate units with tight seams, joints, roll exposed edges.
2. Hang doors, access panels with full length stainless steel piano hinge.
3. Conceal anchorage where possible.

C. Recessed Toilet Accessories, General:

1. Except where otherwise indicated, fabricate all welded units, without mitered corners.
2. Hang doors, access panels with full-length stainless steel piano hinges.
3. Fully conceal anchorage when unit closed.

D. Accessories scheduled at end of section form basis of quality required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Toilet Accessories:

1. Mirrors (M):

a. Location: Over each lavatory, elsewhere indicated; not required over cabinet sinks unless specifically indicated.
b. Mounting: Heights indicated, except bottom of handicap mirrors max. 40" above finish floor. 34 inches to bottom for Childs restroom

2. Paper Towel Dispensers (PTD):

    a. Location: Over each lavatory, wash fountain, elsewhere indicated; not required at cabinet sinks unless specifically indicated.
    b. Mounting: Max. 40" from finish floor to towel dispensing slot.

3. Toilet Tissue Dispensers (TTD):

    a. Location: One each water closet.
    b. Mounting: 3'-0" from rear wall, 2'-0" from centerline to finish floor. 17-19 inches for Child restroom

4. Paper Towel Receptacles (PTR):

    a. Location: Where indicated; if not indicated, directed by Architect.

        1) Free Standing Receptor: One each toilet, elsewhere indicated.

    b. Mounting (Wall Mounted Receptor): Top 28" above finish floor unless otherwise indicated.

5. Soap Dispensers (SD):

    a. Location: One each lavatory, elsewhere indicated; not required above wash fountains and counter sinks unless specifically indicated.
    b. Mounting:

        1) Wall Mounted: Center above lavatory unless otherwise indicated; max. 3'-4" above finish floor to level of soap discharge or plunger.32inches for child's restroom.
        2) Deck Mounted: Left rear of lavatory, extend spout over edge of bowl.
        3) Lavatory Mounting: In opening in lavatory.

6. Grab Bars (GB):

    a. Location:

        1) Handicapped water closets.

    b. Mounting:

        1) At handicapped water closets:

            a) Side wall nearest water closet, edge of 48" unit 6" from rear wall.
            b) Behind water closet, edge of 36" unit 6" from nearest side wall.

    c. 33" above finish floor to centerline horizontal bars.
    d. 25-27 inches for Childs restroom.
    e. 1½" clearance between grab bar and wall; mount to withstand min. 250 lb. vertical load after installation.

D. Miscellaneous Accessories:

1. Mop and Broom Holder (MBH):

   a. Location: Each janitor's space containing floor or janitor's sink.
   b. Mounting: 4'-0" above finish floor.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces according to manufacturer's written instructions.

3.3 TOILET ACCESSORY SCHEDULE

SYMBOL	CATALOG NUMBERS	DESCRIPTION
TOILET ACCESSORIES		
M	A&J - U700T ASI - 0600B Bobrick - B-2908 Series Bradley - 700-2 McKinney/Parker - 150TG	Mirror: Stainless steel frame, 1/4" thick , tempered glass, Type I, Class 1, Quality q2, Kind FT, conforming to FS DD-G-451, with silvering, copper coating, and protective organic coating complying with FS DD-M-411; 18" wide x 30" high unless otherwise indicated on drawings.
PTD	A&J – ASI – 0210 Bobrick – B-2620 Series Bradley – McKinney/Parker –	Surface-Mounted Towel Dispensers: Stainless steel unit, hinged front, tumbler lockset; pierced refill indicator slots at sides; cap. min. either 400 C-fold or 700 multi-fold towels.
TTD	VonDrehehle Corp. - 3253	Twin Jumbo Roll Dispenser
PTR	A&J – U466 ASI - 0829 Bobrick - B-268 Bradley - 360 McKinney/Parker - 636	Stainless steel, seamless exposed walls, continuously welded bottom pan; removable heavy-duty vinyl liner, secured min. 3 points by stainless steel grommets and hooks; min. 13 gal. cap.
SD	SPATAN 975600	Lit and Foamy – White
GB	At H.C. water closets: A&J - UG30BX-48; UG30AX-36 ASI - 3202P-48; 3201P-36 Bobrick - B-62061.99 x 48"; B-6206.99 x 36" Bradley - 8122-00248; 8122-00136 McKinney/Parker - 9605F-48CP; 9605F- 36	Grab Bars: Stainless steel, Min. 18 (.050") gage wall thickness; concealed mounting, manufacturer's standard flanges and anchorages,1½" clearance between wall and inside face of bar; Manufacturer's standard non-slip texture; heavy-duty 1½"OD. At H.C. showers modify to meet dimensional requirements indicated.

EHD	Excel, Xlerator Columbia Vortex Dyson Air Blade	Electric Hand Dryers: Mounting: Surface Finish: Porcelain Enamel Nozzle: Fixed Controls: Solid state infrared sensor touchless. Air speed 75-100 m/s @ 60cfm Dry Cycle Time: less than 10 seconds. Electric: 208-230Y. 2300 watts.
GB	At H.C. water closets: A&J - UG30BX-48; UG30AX-36 ASI - 3202P-48; 3201P-36 Bobrick - B-62061.99 x 48"; B-6206.99 x 36" Bradley - 8122-00248; 8122-00136 McKinney/Parker -9605F-48CP; 9605F- 36	Grab Bars: Stainless steel, Min. 18 (.050") gage wall thickness; concealed mounting, manufacturer's standard flanges and anchorages,1½" clearance between wall and inside face of bar; Manufacturer's standard non-slip texture; heavy-duty 1½"OD. At H.C. showers modify to meet dimensional requirements indicated.
MISCELLANEOUS ACCESSORIES		
MBH	A&J - UJ13B ASI - 8215B Bobrick - B-223 x 36" Bradley - 995-4 McKinney/Parker - 233 x 36"	Mop and Broom Holder: 18-gage (.050") Type 304 stainless steel "hat" channel with spring loaded rubber cam type mop/broom holders; min. 36" long, 4 holders.
SYMBOL	CATALOG NUMBERS	DESCRIPTION
BCS	Brocar 100E Koala “Bear-Care” Horizontal Safe-T-Strap “Diaper Depot”	Baby Changing Station: Wall hung molded polyethylene case and table, continuous stainless steel piano hinge, bed liner dispenser, safety straps, manufacturer’s standard features, color selected by Architect.
AED	AED Cabinet: AED Brands” Designed to accept Defibrillator Below Defibrillator; Zoll -AED Plus	Cabinet semi receesed -17 x 7 x15 Integral alarm with battery and on off switch Stainless steel Defibrillator; Zoll CPR-D-Padz , 5 year shelf Life. 5.25 x 9,5 x 11.5 inches, Meets UL60601-1, AAMI DF-39, IEC 601-2- 4, EN60601-1, IEC60601-1-2.
SHOWER AND BATH ACCESSORIES		
ST	A&J - UX80-A ASI - 0407 Bobrick - B-4380 Bradley - 9401 McKinney/Parker - 1071	Recessed Soap Tray: Stainless steel one piece construction, recessed wall mounting; mounting clamp or lugs appropriate for wall construction.
TP	A&J - UX111B ASI - 7301B Bobrick - B-677 Bradley - 9315 McKinney/Parker - 1445	Towel Pins: Min 3" projection bright polished finish Type 304 stainless steel, rectangular pin and brackets; galvanized backplate, concealed mounting.

RH	A&J - UX110B ASI - 7340B Bobrick - B-671 Bradley - 9115 McKinney/Parker - 1444	Single Robe Hook: Min. 2" projection, bright polished finish Type 304 stainless steel, rectangular brackets, galvanized backplates for concealed mounting.
SCR	A&J - UX2-B ASI - 1206-1209 Bobrick - B-6107 McKinney/Parker - 267	Shower Curtain Rod, Normal Duty: 1" O.D., 20-gage (.040") stainless steel satin finish; 3" O.D. or 2½" square, min. 20-gage stainless steel flanges, satin finish, exposed fasteners.
SCH	A&J - 250P ASI - 1200V Bobrick - B-204 (width required) Bradley - 9333 McKinney/Parker - 269SC	Shower Curtain, Vinyl: width required x 72" high, x 8 mil opaque matte vinyl material, hemmed edges, corrosion resistant grommets 6" o.c. through top hem; white color unless otherwise indicated; chrome plated or stainless steel spring wire curtain hooks, snap fasteners, sized for specified curtain rod.
FSS	A&J - U933P-R or -L ASI - 8210A Bobrick - B-5171 or B-5181 Bradley - 956 or 9561 McKinney/Parker - 274	Folding Shower Seat: Heavy-duty hinged seat, fold up against wall when not in use; Type 304 stainless steel support braces, hinges, frame, fasteners; all welded tubular frame construction for max. strength; "L"-shaped seat, easy wheelchair access; phenolic or polymeric composite seat, either slat type or onepiece construction; color selected from manufacturers standard selections.

END OF SECTION 10 2800

SECTION 10 4413 - FIRE PROTECTION CABINETS

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. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 10 4416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.3 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

E. Product Schedule: For fire-protection cabinets. Indicate whether recessed. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Activar Construction Products Group, Inc. - JL Industries.
b. Babcock-Davis.
c. Fire-End & Croker Corporation.
d. Guardian Fire Equipment, Inc.
e. Larsens Manufacturing Company.
f. Nystrom.
g. Potter Roemer LLC; a Division of Morris Group International.
h. Strike First Corporation of America (The).

B. Cabinet Construction: Nonrated and fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

D. Recessed Cabinet:

1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Cabinet Trim Material: Aluminum sheet.

F. Door Material: Aluminum sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Silk-screened.
3) Lettering Color: Black.
4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.

b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: As selected by Architect from manufacturer's full range.

2. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

a. Finish: Clear anodic.

3. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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 walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:

1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:

1. Provide lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 4413

SECTION 10 4416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 10 4413 "Fire Protection Cabinets."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

B. Drawing Type Designations

1. Type "A": Specified extinguisher contained in specified cabinet.
2. Type "B": Specified extinguisher supported by specified bracket.

1.8 WARRANTY

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

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Activar Construction Products Group, Inc. - JL Industries.
b. Babcock-Davis.
c. Fire End & Croker Corporation.
d. Kidde; Carrier Global Corporation.
e. Larsens Manufacturing Company.

f. Nystrom.
g. Pyro-Chem; brand of Johnson Controls International plc, Building Solutions North America.
h. Strike First Corporation of America (The).

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

C. Purple-K Dry-Chemical Type in Aluminum Container: UL-rated 120-B:C, 20-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Activar Construction Products Group, Inc. - JL Industries.
b. Amerex Corporation.
c. Kidde; Carrier Global Corporation.
d. Larsens Manufacturing Company.
e. Nystrom.
f. Potter Roemer LLC; a Division of Morris Group International.
g. Strike First Corporation of America (The).

2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 4416

SECTION 10 5616 – WOOD UTILITY STORAGE SHELVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Install pre-manufactured wood storage shelving labeled on Drawing as miscellaneous shelving.
2. Provide within a 2” of wall and 12” latch side of doors to all elevations (4) walls.

    a. Janitors closets only provide one (1) unit 72” tall five (5) shelves 42” long.

1.3 COORDINATION

A. Coordinate sizes and locations of blocking and backing required for installation of wood storage shelving attached to wall and ceiling assemblies.

B. Coordinate locations and installation of wood storage shelving that may interfere with ceiling systems including lighting, HVAC, speakers, sprinklers, access panels, electrical switches or outlets, and floor drains.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Submit manufacturer's detailed product description.
2. Indicate unit construction including finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Indicate materials, methods of assembly and jointing, thickness of parts, location and type of hardware.
3. Include installation details of connectors, lateral bracing and special bracing.

4. Take measurements at the site for space where each item is to be placed.

C. Samples: For each type of wood storage shelving and for each color specified.

D. Product Schedule: For wood storage shelving.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wood storage shelving to include in maintenance manuals.

1.8 QUALITY ASSURANCE

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

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver storage units only after building is enclosed and wet operations in building are completed.

B. Protect finished surfaces from soiling and damage during handling and installation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wood storage shelving until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOOD UTILITY STORAGE SHELVING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Excalibur Shelving Systems, Standard Pine.
2. Leonard Peterson, “Reagent, storage system.”
3. Palmetto Shelving Systems, Inc.

2.2 MATERIALS AND COMPONENTS

A. Uprights: Premium Grade Western Hemlock (1-1/2" x 1-5/16").

1. 3/8" x 5/8" deep plow entire length of stiles to receive shelf end channels with 3/16" drilled holes on 1" centers.
2. Stiles are to be locked together with three or more cross members mortised glued and pinned into the stiles.
3. All components are to be machined smooth with all outside corners eased.
4. Uprights to be 84”H unless otherwise noted by plans.

B. Shelves: 3/4" pine shelf materials are to be machined to accept roll formed steel end channels shaped to fit over each end of the shelf and to rest on the shelf support pins. Finger joints are not acceptable.

1. Seven (7) shelves per section unless otherwise indicated on plans.

C. Shelf Support Pins: Non-rusting alloy, 3/16" diameter x 1-14" long, 5/16" diameter head.

D. "X" Braces: Two 18 gauge galvanized 3/4" steel straps with holes punched at each end. Rivet straps at centers. Provide as manufacturer recommends for stability.

E. Back Panels: All back-to-back units for book storage to have 1/8" Abitibi S2S tempered hardboard back panels.

F. Kickboard: Provide a continuous prefinished 4" pine kickboard for each elevation.

G. Finish: Shelving up to 28” D shall have a UV Finish, shelving deeper than 28” D shall be factory seal and lacquer (site finish is not acceptable).

2.3 FABRICATION

A. Manufacture shelving in sizes as necessary to fit wall-to-wall as indicated on the Drawings. Gaps in excess of 2" are not acceptable.

1. Where dead corners are indicated on drawings, solid end panels will be required.
2. Shelves shall not exceed 42" in length in general storage areas and 36" in book storage rooms. Shelves with inset end supports and/or less than 3/4" thick must be pre-approved (sample required) and may not exceed 30" in length.
3. Modifications for shelves with inset end supports must be performed by the manufacturer. Field modifications will not be accepted.
4. Unless otherwise indicated, all units shall receive 5 shelves over 84” high.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed. All overhead work including functional lights, flooring including cove base and final coat of paint must be complete prior to installation of shelving.

B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C. Examine floors for suitable conditions where wood storage shelving will be installed.

D. Examine walls to which wood storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.

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

3.2 INSTALLATION

A. Install in strict accordance with manufacturer's current instructions and approved shop drawings.

B. Anchor all wall units.

3.3 ADJUSTING

A. Adjust wood storage shelving so that connectors and other components engage accurately and securely.

B. Touch up marred finishes or replace wood storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by wood storage shelving manufacturer.

C. Replace wood storage shelving components that have been damaged beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 5616

SECTION 10 7516 - GROUND-SET FLAGPOLES

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 ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: Flags.

C. Extend and location of each type of flagpole shown on Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles.

1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
2. Include section, and details of foundation system.

C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpoles.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

B. Deliver flagpoles and accessories completely identified for installation procedure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design flagpole assemblies.

B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is on Structural drawings.
2. Base flagpole design on nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acme/Lingo Flagpoles, LLC.
b. American Flagpole.
c. Concord Industries, Inc.
d. Eder Flag Manufacturing Company, Inc.
e. Ewing Flagpoles.
f. Pole-Tech Company Inc.
g. U.S. Flag & Flagpole Supply, LP.

B. Exposed Height: 35 feet. Verify with Drawings.

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch-diameter, steel

ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

1. Flashing Collar: Same material and finish as flagpole.

E. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.

1. Flashing Collar: Same material and finish as flagpole.

F. Cast-Metal Shoe Base: Made from aluminum with same finish and color as flagpoles for anchor-bolt mounting; furnish with anchor bolts.

1. Furnish ground spike.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch spun aluminum with gold anodic finish.

B. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch-diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.

1. Halyards and Cleats: Two at each flagpole.
2. Cleat Covers: Cast metal, finished to match flagpole, secured with cylinder locks.
3. Halyard Covers: 2-inch channel, 60 inches long, finished to match flagpole.
4. Halyard Flag Snaps: Stainless-steel swivel snap hooks. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C33/C33M, fine aggregate.

D. Elastomeric Joint Sealant: Single-component nonsag urethane joint sealant complying with requirements in Section 07 9200 "Joint Sealants."

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34.

1. Color: Medium bronze. Verify with Drawings.
2. 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 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Place concrete, as specified in Section 03 3000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

G. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 10 7516

SECTION 12 2413 - ROLLER WINDOW SHADES

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. Motor-operated roller shades with single rollers.
2. Room-Darkening Channels.

B. Related Requirements:

1. Division 26 – Electrical.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 3 inches square. Mark interior face of material if applicable.
2. Installation Accessories: Full-size unit, not less than 10 inches long.

E. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

1. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, LLC.; ElectroShade or comparable product by one of the following:

    a. Draper, Inc.
    b. Hunter Douglas, Inc.
    c. Levolor Inc.
    d. Lutron Electronics Co., Inc.

B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

    a. Electrical Characteristics: 110-V ac., 60 Hz.
    b. Maximum Total Shade Width: As required to operate roller shades indicated.
    c. Maximum Shade Drop: As required to operate roller shades indicated.
    d. Maximum Weight Capacity: As required to operate roller shades indicated.

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades.

    a. Keyed Control Station: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.

4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
6. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts. Each elevation.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated

without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Room-Darkening Channels.

1. Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.
2. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.

F. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

    a. Shape: L-shaped.
    b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.

2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

    a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.
    b. Exposed shade housing and side channel color clear anodized to match window range.

3. Endcap Covers: To cover exposed endcaps.

4. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

    a. Closure-Panel Width: As indicated on Drawings.

5. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
6. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Type: PVC-coated polyester.
2. Weave: Mesh.
3. Thickness: Refer to Finish Schedule.
4. Weight: Refer to Finish Schedule.
5. Roll Width: Per width of glazed opening.
6. Orientation on Shadeband: Up the bolt, unless otherwise noted.
7. Openness Factor: Refer to Finish Schedule.
8. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system and other conditions affecting performance of the Work.

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

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Roller Shade Locations: At exterior windows, except where noted on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 12 2413

SECTION 12 6100 - FIXED AUDIENCE SEATING

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 fixed audience seating with the following:

1. Standard mounting.
2. Upholstered chairs.

1.3 COORDINATION

A. Coordinate layout and installation of diffuser pedestals with HVAC work and with properties of diffuser pedestals to ensure alignment, proper air diffusion, and correct seat locations.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of components, and finishes for fixed audience seating.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Seating Layout: Show seating layout, aisle widths, aisle-end alignment or stepping, row-lettering and chair-numbering scheme, chair widths, and chair spacing in each row.

C. Samples for Initial Selection: For each type of exposed color, finish, texture, and pattern indicated.

1. Include Samples of accessories involving color and finish selection.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fixed audience seating.

B. Material Certificates: For each type of flame-retardant treatment of fabric.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fixed audience seating to include in operation and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

a. Maintenance of self-rising seat mechanisms, folding armrests, and other operating components.
b. Adjustment of self-rising seat mechanisms to align seats.
c. Maintenance of electrical components, devices, and accessories.
d. Methods for maintaining upholstery fabric.
e. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including standards, beams, and pedestals.
b. Faulty operation of self-rising seat mechanism.
c. Wear and deterioration of fabric and stitching beyond normal use.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Periods: As follows, from date of Substantial Completion.

a. Structural: Five years.
b. Operating Mechanisms: Five years.
c. Plastic, Wood, and Paint Components: Five years.
d. Gravity Operated Counterweight Seat Return: Lifetime

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.

1. Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics of Upholstered Chairs:

1. Fabric: Class 1 according to DOC CS 191-1953 or 16 CFR 1610, tested according to California Technical Bulletin 117.
2. Padding: Comply with California Technical Bulletin 117.
3. Full-Scale Fire Test: Comply with California Technical Bulletin 133.

B. Strength and Durability Performance: Chairs and components shall pass testing according to BIFMA X5.4.

2.3 FIXED AUDIENCE SEATING

A. Fixed Audience Seating: Assembly-space seating in permanent arrangement as shown on Drawings.

1. Manufactures:

a. Leadcom Seating (Basis of Design) “Performer LS-13601N”
b. Irwin Seating
c. Hussey Seating
d. TSI Group - Theatre Solutions
e. KI Seating
f. Davis Seating

B. Chair Mounting Standards: Floor attached of the following material:

1. Steel: One-piece, heavy-tube or reinforced sheet with welded mounting plate and welded connections for seat pivots, backs, armrests, and end panels.

C. Fabric Upholstered Seat:

1. Outer Seat Pan: Injection Molded Polypropylene
2. Cushion Style: Waterfall with Molded Urethane Foam on Serpentine Spring Support
3. Foam and Fabric Meet Cal 117 Flammability requirements

D. Fabric Upholstered Seat Back:

1. Backrest: Injection Molded Polypropylene with squared-off design
2. Back Height: Standard-style Low, Minimum 33” at 20 degree back-pitch
3. Foam and Fabric Meet Cal 117 Flammability requirements
4. Foam mounted to Plywood Backing attached to PP outer shell.

E. End Panels:

1. Laminate End Panel with PVC Banding

2. Soft Squared-Off Design

F. Arm Rests:

1. Injection Molded Polypropylene
2. Attractive Soft Rounded -Edge Design

G. Chair Width: with minimum chair width of 22 inches from center to center of armrests.

H. Chair Seat Hinges: Self-lubricating, with noiseless self-rising seat mechanism passing ASTM F 851, positive internal stops cushioned with rubber or neoprene, and requiring no maintenance.

I. Aisle-Lighting Fixtures: Not Used

J. Accessible Seating:

1. Provide removable chair for each wheelchair space unless otherwise indicated.
2. Provide chairs with folding armrest on aisle side in locations indicated, but not less than five percent of aisle seats, dispersed through the audience seating area. Identify these seats with a sign or marker.

K. Row-Letter and Chair-Number Plates: Manufacturer's standard.

1. Material: Aluminum with black embossed characters.
2. Attachment: Minimum of two mechanical fasteners.

L. Accessibility-Logo Plates: Manufacturer's standard.

1. Material: Aluminum with black embossed characters.
2. Attachment: Minimum of two mechanical fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Verify that electrical connections are properly located.

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

3.2 INSTALLATION

A. Install seating in locations indicated and fasten securely to substrates according to manufacturer's written installation instructions.

1. Install fixed audience seating with each chair capable of complying with performance requirements without failure or other conditions that might impair the chair's usefulness.
2. Install standards and pedestals plumb.
3. Install seating so moving components operate smoothly and quietly.

B. Install seating with end standards aligned or stepped as indicated from first to last row and with backs and seats varied in width and spacing to optimize sightlines.

C. Install riser-mounted standards and attachments to maintain uniform chair heights above floor.

D. Install chairs in curved rows at a constant radius.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Inspect components, assemblies, and equipment, including connections, to verify proper, complete, and sturdy installation according to manufacturer's written instructions and product specifications.
2. Verify that seats return to correct and uniform at-rest position.

B. Fixed audience seating will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust chair backs so that they are at proper angles and aligned with each other in uniform rows.

B. Adjust hardware and moving parts to function smoothly so they operate easily. Lubricate bearings and sliding parts as recommended in writing by manufacturer.

C. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.

D. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

E. Replace damaged and malfunctioning components that cannot be acceptably repaired.

F. Replace upholstery fabric damaged during installation or work of other trades.

END OF SECTION 12 6100

SECTION 14 2400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Machine room-less hydraulic passenger elevators as shown and specified.
2. Elevator work includes:

    a. Standard pre-engineered hydraulic passenger elevators.
    b. Elevator car enclosures, hoistway entrances and signal equipment.
    c. Operation and control systems.
    d. Jack(s).
    e. Accessibility provisions for physically disabled persons.
    f. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
    g. Materials and accessories as required to complete the elevator installation.

B. Two-Way Emergency Communications Visual Device

1. The ASME A17.1-2019 and IBC 2018 codes require in-elevator two-way emergency communication systems for the hearing impaired. Refer to chapter 30 of the IBC.

C. Related Requirements:

1. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.

2. Division 22 Plumbing

    a. Sump pit and oil interceptor.

3. Division 23 Heating, Ventilation and Air Conditioning

    a. Heating and ventilating hoistways and/or control room.

4. Division 26 Electrical Sections:

    a. Providing electrical service to elevators, including fused disconnect switches where permitted. (note: fused disconnect switch to be provided as part of elevator manufacture product, see Miscellaneous elevator components for further details.).
    b. Emergency power supply, transfer switch and auxiliary contacts.
    c. Heat and smoke sensing devices.
    d. Convenience outlets and illumination in control room (if applicable), hoistway and pit.

D. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the TK Elevator's proposal, since it is a part of the building construction.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.

22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 1/2 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

1.2 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.

    a. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
    b. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
    c. Indicate electrical power requirements and branch circuit protection device recommendations.

2. Include large-scale layout of car-control station and standby-power operation control panel.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.

C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes, 3-inch-square Samples of sheet materials and 4-inch lengths of running trim members.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service including standby-power generator, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard two-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

D. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in same form as, "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.

1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.

a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.

2. The manufacturer shall have a documented, on-going quality assurance program.
3. ISO-9001:2000 Manufacturer Certified

4. ISO-14001:2004 Environmental Management System Certified

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:

1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. Building Code: IBC, International Building Code, latest edition.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
6. Section 407 in ICC A117.1, when required by local authorities

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:

1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.8 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.9 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: One year(s) from date of Substantial Completion.

1.10 MAINTENANCE

A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.

1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ThyssenKrupp Elevator; TK Elevator’s Endura Machine Room-Less hydraulic elevator or a comparable product by one of the following:

1. American Crescent Elevator Mfg., Corp.
2. Otis Worldwide Corporation; HydroFit Hydraulic Elevator.
3. Schindler Elevator Corp.
4. Schumacher Elevator Co.

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, are manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Standard: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

C. Seismic Performance: Elevator system withstands the effects of earthquake motions determined according to ASCE/SEI 7 and complies with elevator seismic requirements in ASME A17.1/CSA B44.

1. Project Seismic Design Category: As indicated on Structural Drawings.
2. Elevator Component Importance Factor: As indicated on Structural Drawings.
3. Provide earthquake equipment required by ASME A17.1/CSA B44.
4. Provide seismic switch required by ASCE/SEI 7.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components are used, as included in standard elevator systems and as required for complete system.

2.4 MATERIALS, GENERAL

A. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

B. Steel:

1. Shapes and bars: Carbon.
2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
3. Finish: Factory-applied powder coat for structural and architectural parts. Color selection must be based on elevator manufacture’s standard selections.

C. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture’s standard selections.

D. Flooring by others.

2.5 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless telescopic 2-stage. Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the Assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section.

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade inherently biodegradable oil as specified by the manufacturer of the power unit, see Power Unit section details.

I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform “flooded pit operation,” which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.6 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:

1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather.
2. An oil hydraulic pump.
3. An electric motor.

4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.

1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.7 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.

1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.
3. Typical door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.

B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See Control Systems for additional requirements.

C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See Miscellaneous Elevator Components for further details.

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.8 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:

1. Walls: Cab type TKLP, durable wood core finished on both sides with high pressure plastic laminate.
2. Reveals and frieze: Not Applicable.
3. Canopy: Cold-rolled steel with hinged exit.
4. Ceiling: Downlight type, metal pans with suspended LED downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six. The metal pans shall be finished with a stainless steel, no. 4 brushed finish.
5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel.
6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.

    a. Door Finish: Stainless steel panels: No. 4 brushed finish.
    b. Cab Sills: Extruded aluminum, mill finish.

7. Handrail: Provide 1.5' diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
8. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top.
9. Protection pads and buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab front(s) and walls.

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.9 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.10 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel:

D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

E. Special Equipment: Not Applicable.

2.11 CONTROL SYSTEMS

A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:

1. Access to main control board and CPU.
2. Main controller diagnostics.
3. Main controller fuses.
4. Universal Interface Tool (UIT).
5. Remote valve adjustment.
6. Electronic motor starter adjustment and diagnostics.
7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit.
8. Operation of auxiliary pump/motor (secondary hydraulic power source).
9. Operation of electrical assisted manual lowering.
10. Provide male plug to supply 110VAC into the controller.
11. Run/Stop button.

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.

E. Special Operation: Not Applicable.

2.12 HALL STATIONS

A. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.

1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.

a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Position Indicator: Not Applicable.

D. Hall lanterns: Not Applicable.

E. Special Equipment: Not Applicable.

2.13 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.

C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

B. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

A. A.Install elevator systems components and coordinate installation of hoistway wall construction.

1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
2. Comply with the National Electrical Code for electrical work required during installation.

B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

D. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.

E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of

sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

I. Lubricate operating parts of system, where recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.5 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.6 PROTECTION

A. Temporary Use: Comply with the following requirements for the elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.

6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

B. Check operation of the elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.8 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service includes 24 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies are manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.

3.9 ELEVATOR SCHEDULE

A. Elevator Qty. 1

1. Elevator Model: endura MRL Twinpost above-ground 2-stage.
2. Elevator Type: Hydraulic Machine Room-Less, Passenger.
3. Rated Capacity: 2500 lbs.
4. Rated Speed: 110 ft./min.
5. Operation System: TAC32H.
6. Travel: 13'-4". Verify in Field.
7. Landings: 2 total.
8. Openings:

    a. Front: 2.
    b. Rear: 0.

9. Clear Car Inside: 6'-6-3/4" wide x 4'-4-1/8" deep.
10. Inside clear height: 7'-4" standard.

11. Door clear height: 7'-0" standard.
12. Hoistway Entrance Size: 3'-6" wide x 7'-0" high.
13. Door Type: One-speed | LH Side opening.
14. Power Characteristics: 208 volts, 3 Phase, 60 Hz.
15. Seismic Requirements: Seismic 0/1.
16. Hoistway Dimensions: 8'-4" wide x 5'-9" deep.
17. Pit Depth: 4'-0".
18. Button & Fixture Style: Traditional Signal Fixtures.

3.10 Special Operations: None.

END OF SECTION 14 2400

SECTION 21 2010 - FIRE PROTECTION SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. It is recognized that separate sub-contracts may be instituted by THIS CONTRACT'S GENERAL CONTRACTOR with others. It is the responsibility of THIS CONTRACT'S GENERAL CONTRACTOR to completely inform, coordinate and advise those sub-contractors as to all of the requirements, conditions and information associated with providing and installing their portion of the total job.

1.2 IMPOSED REGULATIONS

A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for plumbing work. In each case, the prevailing edition shall be the current adopted edition of the state where the project is located.

1. International Fire Code.
2. NFPA Documents.

1.3 SCOPE:

A. Fire Protection Supply Pipe: Route the building fire main to the city water main and connect to the supply line at the appropriate time and location. Contractor shall field verify exact location of water main prior to start of construction.

B. Work Includes but is not limited to:

1. Installing a complete "wet pipe" Automatic Sprinkler system throughout the building.
2. Include all material, Labor, coordination and inspections and re-inspections to provide a complete and working Fire Protection system.
3. System shall be complete and working as regulated by the authorizes having jurisdiction.
4. Wiring of signal and alarm devices furnished by Sprinkler Installer is specified in Division 26 - Electrical.

C. Stand Pipes;

1. Provide Two (2) on stage Platform / Stage. VERIFY WITH DRAWINGS.

D. Sprinkler Design Requirements:

1. The sprinkler system shall be a wet pipe type. The design area shall be the most remote 1500 square feet. The design density for light hazard shall be .10 gpm/ft^2. Hose requirement for light hazard shall be 100 gpm. The design density for ordinary hazard – group 1 shall be .15 gpm/ft^2. Hose requirement for ordinary hazard – group 1 shall be 250 gpm. The design density for ordinary hazard – group 2 shall be .20 gpm/ft^2. Hose requirement for ordinary hazard – group 2 shall be 250 gpm.
2. The contractor shall submit 4 complete sets of sprinkler shop drawings and hydraulic calculations to the Architect for review, prior to ordering material and/or cutting pipe. Contractor shall not cut any piping until shop drawings have been reviewed and accepted. The contractor shall show in dashed lines the location of all ductwork, lights and diffusers.
3. The contractor shall be responsible for coordinating sprinkler piping and heads locations with other trades. Contractor shall relocate sprinkler piping and heads as necessary in order to avoid conflict with ductwork, lights and structure. The Architect's representative shall have final authority on coordination issues.
4. Provide auxiliary drains at low points in system and for trapped sections as required by NFPA-13. Locate auxiliary drains in mechanical closets or other locations out of sight.
5. The contractor shall include a ten pound (10 psi) buffer in the hydraulic calculations, i.e. the pressure required for the sprinkler system (including hose stream) shall be a minimum of 10 psi less than the available pressure at the required flow.
6. The contractor shall perform a flow test prior to commencing design and shall provide test information to the Architect for approval. Sprinkler system design shall be based upon the contractor's flow test.
7. All fire sprinkler control valves shall be electronically monitored, including Post Indicator Valve.
8. Inspectors test connection(s) shall discharge to the outside of the building to a location acceptable to the Architect.
9. Riser detail is shown on Civil drawings.
10. Provide a fire pump if necessary to make system operational.

1.4 QUALITY CRITERIA

A. Permits, Licenses, Inspection Fees:

1. Obtain and pay for permits, licenses and inspection fees as may be required for performance and approval of the work performed under this section of the specifications.
2. Comply with all requirements of NFPA 13, NFPA-24 and the State Fire Marshall and local codes.

B. Materials: Materials specified by manufacturer's name shall be used unless prior approval of a substitute is given by addenda.

1.5 ACTION SUBMITTALS

A. The purpose of submittals is to demonstrate to the Architect/Engineer that the Contractor understands the design concept. The Architect/Engineer's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has, in writing, called the Architect/Engineer's attention to such deviations at the time of submission, and has received from the Architect/Engineer, in writing,

permission for such deviations. All submittals must be completely checked by the Contractor prior to submission for review.

1. Shop Drawings shall be completed according to NFPA 13, Chapter 14, 14.13 Working Plans.

B. Coordinate fire protection submittals through the Contractor for the general work, and mark each submittal with his name and the date of the transmittal to the Architect/Engineer. Prior Approvals or Submittals must be received by mail or be hand delivered. Submittal data received by facsimile machine is not acceptable and will not be reviewed.

C. Other Action Submittals: Coordinate with Section 33 1125 - Fire Pumps and Tanks.

1. Fire Pump, Pipe Size and Fittings Schedule: Prior to submittal to Architect. Coordinate final schedule of equipment with Wet Pipe Sprinkler Engineer Detailing Size of Pump size of pipe and fittings, as well as installation procedures and diagrams.
2. Submittal Sequence: Submit Pump and fitting schedule concurrent with “Wet Pipe.
3. Submittal Sequence: Submit Pump and fitting schedule concurrent with “Wet Pipe Sprinklers “submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of and scheduling requirements of other work including Wet Pipe Sprinklers to facilitate the fabrication of other work that is critical in Project construction schedule.
4. Sprinklers “submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of and scheduling requirements of other work including Wet Pipe Sprinklers to facilitate the fabrication of other work that is critical in Project construction schedule.

D. Submittals shall be made by specification section. Submittal data shall be placed in one or more hard-back 3-ring binders, arranged and labeled according to specification section.

1. Each binder shall contain a title page and table of contents. Provide separator tabs, and label by specification section. Make note in the table of contents, any drawings that accompany the submittal.
2. Title page shall contain Project Name, Contractor’s Name, Division 21 Superintendent’s name, Suppliers and point of contact for each, and date.

E. Manufacturer's Data: Where pre-printed data is submitted for more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided. Delete or mark-out significant portions of preprinted data which are not applicable. Where operating ranges are shown, mark data to show portion of range required for project application. Expansion or elaboration of standard data to describe a non-standard product must be processed as a shop drawing submittal. For each product include the manufacturer's production specifications, installation or fabrication instructions, nearest source of supply (including telephone number), sizes, weights, speeds, operating capacities, piping and service line connection sizes and locations, statements of compliance with required standards and governing regulation (include manufacturer's signed statements if not covered in printed data), performance data (where applicable) and similar information needed to confirm compliance with the requirements.

F. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable style number.

G. Sprinkler heads shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.6 TESTING PIPE SYSTEMS

A. Tests shall be conducted in the presence of the Architect or his designated representative. Equipment, materials, and instruments for testing shall be furnished by the Contractor without additional cost to the Owner.

B. Automatic Sprinkler Piping: The automatic sprinkler systems shall be hydrostatically tested in their entirety or in zones defined by shut-off valves. The piping shall be tested at a pressure of 200 psig, measured at the low point in the system or zone, and shall be proved tight at this pressure for a period of not less than two hours. Leaks detected shall be repaired by tightening, rewelding joints, or replacing damaged pipe or fittings. Caulking of joints will not be permitted.

1.7 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Operating and Maintenance Instructions, printed and bound in hard cover three ring loose leaf notebooks, shall be provided for each item of equipment listed below; 5 separate copies shall be provided. Each notebook shall be provided within an identifying label under a clear plastic cover shield on the front cover which shall identify the Project, Engineer, Contractor and Date.

1. National Fire Protection Association Pamphlet No. 25. Photo copies are not acceptable.
2. Copies of All Approved Submittal Data (listed above under submittals).
3. As-Built copies of Design Drawings and Hydraulic Calculations.

1.8 CLOSEOUT REQUIREMENTS

A. Operating Instructions: Submit manufacturer's operating instructions for each item of fire protection equipment and supplement with additional project application instructions where necessary. Prepare and submit specific operating instructions for charging, start-up, control or sequencing of operation, phase or seasonal variations, shut-down, safety and similar operational instructions. Prepare in typewritten form in completely explained and easily understood English language.

B. General Recording Procedure: Maintain a white-print set, blue-line or black-line, of fire protection contract drawings and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever drawings are most capable of showing the installed conditions accurately; however, where shop drawings are marked, record a reference note on appropriate contract drawing. Mark with erasable pencil and use multiple colors to aid in the distinction between work of separate systems. In general, record every substantive installation of fire protection work which previously is either not shown or shown inaccurately, but in any case record the following:

1. Underground and aboveground piping, both exterior and interior, drawn to scale and fully dimensioned.

2. Fire protection "Project Record" shall be maintained as part of the "Project Record" specified in Division 1.

C. Maintenance Manuals: Organize each copy of the required system maintenance manuals to include an index followed by thumb-tab marked sections for each of the following:

1. System operating instructions.
2. Emergency instructions including addresses and telephone numbers of service sources.
3. Regular system maintenance procedures including lubrication.
4. Spare parts listing and stocking recommendations.
5. Inspection, adjusting, rebalancing, cleaning, parts replacement, and similar maintenance instructions and recommendations, including the proper use of tools and accessories.
6. Valve schedule and control diagram for each system.
7. Manufacturer's data for each operating item in each system.
8. Manufacturer's product warranties and guarantees relating to the system and equipment items in the system.
9. Corrected or approved issues of submittal items relating to the system.
10. Bind each maintenance manual in one or more vinyl-covered, 2", 3-ring binder, plus pocket-folder type binders for folded drawings, and mark the back spine of each binder with system identification and volume number.

D. Maintenance Materials: Deliver to Owner’s representative at the location as directed, in containers or packages suitable for storage and fully identified.

1.9 SEISMIC REQUIREMENTS

A. Provide seismic protection for the sprinkler system. Design and install seismic protection in accordance with the requirements of NFPA 13 section titled "Protection of Piping Against Damage Where Subject to Earthquakes."

1.10 WARRANTIES

A. All equipment shall be guaranteed as specified under the General and Special Conditions. Guarantee on all equipment shall start and coincide with the Contractor's guarantee obligations.

B. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than Two (2) year.

1. Fire Protection Sprinkler Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition. Warranty period 2 years.

PART 2 - PRODUCTS AND INSTALLATION

2.1 PIPE AND FITTINGS:

A. Pipe and fittings listed herein shall be for the services indicated.

2.2 SPRINKLER AND STANDPIPE:

A. Piping Options:

1. Schedule 40 black steel pipe: ASTM A-795, A-53, or A-135 with class 150 or 300 pound malleable iron threaded fittings, welded steel fittings, or with mechanical grooved joint couplings. Mechanical couplings for main sprinkler and standpipe risers shall be rigid type coupling.
2. Schedule 10 black steel pipe: ASTM A-135 pipe, UL listed for sprinkler systems.
3. Fittings for thin wall pipe shall be same type specified for Schedule 40 pipe.

2.3 JOINTS:

A. Mechanical grooved joint couplings shall be listed for use in fire protection systems.

1. Grooved End Fittings: Fittings shall be ductile iron (ASTM A536); forged steel (ASTM A234); or fabricated from carbon steel pipe (ASTM A53); with pre-grooved ends for use with mechanical couplings of the same manufacturer.
2. Mechanical Couplings: Coupling housings shall be ductile iron (ASTM A536). Bolts and nuts shall be carbon steel track-type (ASTM A183), minimum tensile 110,000 psi.
3. Gaskets shall be Grade “E” EPDM, for water services from -30 to +230EF. At joints allowing controlled movement, expansion, contraction of deflection, flexible couplings with shall be used. At all joints not requiring flexibility, a rigid coupling shall be used.

    a. Rigid Type: Coupling housings cast with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with NFPA 13.
    b. Flexible Type: Use in locations where vibration attenuation and stress relief are required.

4. Flange Adapter: Flat face, for direct connection to ANSI Class 125 or 150 flanged components.

B. Welded flanged joints shall be faced true, provided with 1/16 inch ring type gasket, and made square and tight. Flanges shall have raised or flat faces to mate with adjacent flanges or valves. Welding shall comply with ANSI B31.1.

C. Welded joints shall be butt welded in accordance with ANSI B31.1.

D. Qualification of Welders:

1. All welders employed for the work shall be qualified under the requirements of ANSI B31.1.0, Section 127.5.

2. Evidence of the welder's qualifications shall be submitted to the Architect before any welds are made.
3. Coupling for sprinkler piping shall be Victaulic Model 75.

E. Underground Pipe:

1. Standard weight ductile iron pipe with mechanical "bolted type" joints.
2. Provide tie rods and thrust blocks at each change of direction of the underground fire service piping. Install tie rods and thrust blocks in accordance with NFPA-24 requirements.

2.4 VALVES, EQUIPMENT AND ACCESSORIES FOR FIRE PROTECTION SYSTEM:

A. Gate Valves 2 1/2 Inch and Larger: Valves shall be O.S. and Y type with iron body, bronze trim, solid wedge, and flanged ends for 175 pound W.W.P. Valves shall be U.L. listed with identification mark for such stamped or cast on valve body. Valve shall be Crane, No. 467; Stockham, G-634, Nibco/Scott, F-607-0 or Kennedy, Figure 68.

B. Gate Valves 2 Inches and Smaller: Valves shall be O.S. and Y type with bronze body, solid wedge, and threaded ends for 175 pound W.W.P. Valves shall be U.L. listed with identification mark for such stamped or cast on valve body. Valves shall be Crane, No. 459; Stockham, B-133; Nibco/Scott, T-104-0 or Kennedy, Figure 66.

C. Check Valves 2 Inches in Size and Smaller: Check valves shall be horizontal swing type with bronze body, composition disc, threaded ends for 200 pound W.O.G. and shall be Crane, No. 34-1/2; Stockham, B-305-B; Nibco/Scott, T-413-W or Kennedy, Figure 440.

D. Swing Check Valves 2 1/2 Inch and Larger: Check valves shall be horizontal swing type with iron body, bronze trim, and flanged ends for 175 pound W.W.P. Valves shall be UL listed with identification mark for such stamped or cast on the valve body. Valves shall be Crane, No. 375; Stockham, G-939; Nibco/Scott, F-0908-B or Kennedy, Figure 126.

E. Wafer Check Valves 4 inch and Larger: Valves shall be iron body with bronze trim, EPDM O-ring seals and stainless steel Hinge pins. Valve shall be UL listed and FM approved Wafer check valves shall be Grinnell Model F512, or equivalent by Victaulic or Gruvlock.

F. Spring-Assisted Check Valves 2½ inch and Larger: Valve shall be UL listed and FM approved. Valves shall have a ductile iron body with aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft and grooved ends. Spring-assisted check valves shall be Victaulic or Gruvlock.

G. Butterfly Valves 2 1/2 inch and Larger: Valve shall be UL listed and FM approved. Valves shall have a ductile iron body, elastomer encapsulated ductile iron disc with integrally cast stem and grooved ends. Butterfly valves shall be Victaulic, Gruvlock, or Kennedy.

H. Globe Valves: Valves shall have bronze body, rising stem, composition disc, threaded ends for 200 pound W.O.G. and shall be Crane, No. 7; Stockham, B-13T; Nibco/Scott, T-211-W or Kennedy, Figure 97.

I. Angle Valves: Valves shall have bronze body, rising stem, composition disc, threaded ends for 200 pound W.O.G. and shall be Crane, No. 17; Stockham, B-222; Nibco/Scott, T-311-W or Kennedy, Figure 98.

J. Sprinkler Wet Pipe Alarm Valves: Valves shall be U.L. listed and shall be furnished with all standard trim including pressure gauges, by-pass, test valves, electric alarm pressure switch and main drain. Valve shall be cast iron or ductile iron, and all parts in contact with water shall be non-ferrous. Internal parts shall be replaceable without removal of valve from installed position. Valve shall be Victaulic Series 751, Central Sprinkler Model 'F', or equivalent by Viking, Grinnell, Automatic Sprinkler or Reliant.

K. Supervisory Switches: The valve for each sprinkler system shall be provided with a valve mounted switch capable of detecting motion of the valve from a full open position. Switches shall be Underwriters Laboratories listed and Factory Mutual approved. Switch shall be System Sensor, United Electrics, Potter or Viking.

L. Water Flow Switches: Water flow switches shall be line mounted vane type with retard. Switch shall consist of two single pole, double throw, snap action switches and an adjustable, recycling pneumatic retard, contained inside a general purpose die-cast housing. Switches shall be capable of either horizontal or vertical mounting, and shall be Underwriters Laboratories listed and Factory Mutual approved. Switch shall be System Sensor, United Electrics, Potter or Viking.

M. Electric Bell: Bell shall be 10” round red enameled steel bell 120 Volt A.C. electric motor. Bell shall be Potter-Roemer 6230 or equivalent by Viking, System Sensor or United Electrics.

2.5 SPRINKLER HEADS:

A. Sprinkler heads shall be glass-bulb type. Body shall be die cast brass, with hex-shaped wrench boss cast into the body to facilitate installation and reduce the risk of damage during installation.

B. Sprinkler heads in ceilings shall be Fully concealed type. Cover color to match Ceiling unless otherwise indicated.

C. Upright sprinkler heads in exposed structure locations shall be 1/2 inch spray type with bronze finish. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

D. Pendent sprinkler heads in un occupied spaces with suspended ceiling as Closet, Book storage/chair shall be quick response 1/2 inch spray type with chrome plated finish and white escutcheon plate. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

E. Dry Pendent sprinkler heads shall be 1/2 inch recessed type with polished brass finish. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

F. Sidewall sprinkler heads shall be quick response 1/2 spray type with chrome plated finish and white escutcheon. Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

G. Concealed pendent sprinkler heads shall be 1/2 inch spray type with chrome plated finish and white escutcheon and ceiling plat. Black in room TV Studio, dark room, Sprinklers shall be Viking, Central Sprinkler, Reliable, Grinnell or Automatic Sprinkler.

2.6 HANGERS FOR FIRE PROTECTION PIPING:

A. Hanger for 4" and larger horizontal lines shall be Clevis type hangers, B-Line B-3100 or equivalent by Anvil, or Erico.

B. Hanger for horizontal lines up to 3-1/2" shall be band type hangers, B-Line Model B-3172 or equivalent by Anvil, or Erico.

C. Supports for vertical lines passing through floor shall be riser clamp type, Fee & Mason Fig. No. 241, Carpenter and Patterson No. 126 or equivalent by B-Line, Anvil or Erico.

2.7 FIRE PUMP

A. Fire Pump, Pipe Size and Fittings Schedule: Prior to submittal to Architect. Coordinate final schedule of equipment with Wet Pipe sprinkler Engineer detailing Size of Pump size of pipe and fittings, as well as installation procedures and diagrams.

1. Coordinate with Section - 33 1125 “Fire Pumps and Tanks.”

B. Submittal Sequence: Submit Pump and fitting schedule **concurrent with** “Wet Pipe Sprinklers “submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of and scheduling requirements of other work including Wet Pipe Sprinklers to facilitate the fabrication of other work that is critical in Project construction schedule.

2.8 FIRE DEPARTMENT CONNECTION:

A. The fire department connection shall be a two way wall mounted type with clappers, caps and chains, and identification base plate. Finish shall be polished brass. Fire department connections shall be Potter Roemer Model 5751 or equivalent by Elkhart or Sierra.

2.9 FIRE PROTECTION IDENTIFICATION MATERIALS:

A. Plastic Pipe Markers:

1. General: Product manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
2. Small Pipe: For external diameters less than 6 inches, provide full band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
b. Adhesive lap joint in pipe marker overlap.
c. Laminated or bonded application of pipe marker to pipe.

d. Taped to pipe with color-coded plastic adhesive tape, not less than 3/4 inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inch.

3. Large Pipes: For external diameters of 6 inches and larger, provide either full-band or strip-type pipe markers, but not narrower than 3 x letter height (and of required length), fastened by one of the following methods:

   a. Laminated or bonded application of pipe marker to pipe.
   b. Taped to pipe with color-coded plastic adhesive tape, not less than 1-1/2 inches wide: full circle at both ends of pipe marker, tape lapped 3 inches.

4. Lettering: Comply with piping system names as specified, scheduled or shown, and abbreviate only as necessary for each application length.
5. Arrows: Print each pipe marker with arrow indicating direction of flow, either integrally with piping system service lettering or as separate unit of plastic (to accommodate both directions).
6. Install pipe markers on piping of the following piping systems:

   a. Automatic Wet Pipe Sprinkler System Water.

B. Plastic Tape: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

1. Width: Provide 1-1/2 inches wide tape markers on pipes with outside diameters of less than 6 inches, 2-1/2 inches wide tape on larger pipes.
2. Color: Comply with ANSI A13.1.

C. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminated, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core, letter color, except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/16 inch, except as otherwise indicated.
3. Fasteners: Self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.

D. Valve Tags:

1. Valve tags shall be 18 gauge (minimum) brass with 1-1/4" (minimum) height and width. Identification letters and numbers shall be stamped in tag and shall be filled with black paint.
2. Valve tags shall be attached to valve using cable ties. Cable ties shall be self-locking nylon ties.
3. Valve tags shall be installed at all shut-off, balancing, metering, and drain valves. Valve tag shape and designations shall with NFPA and UL.

E. Valve Charts:

1. Valve charts shall be provided for fire protection systems. Charts shall be located at the riser.
2. Valve charts shall be typed listing all valve tags. List shall include identification number, valve location in system (e.g., Corridor 123, etc.) and its function (e.g., shut-off, balancing, drain, etc.). Charts shall be mounted in a wooden frame with glass cover.

2.10 FREEZE PROTECTION:

A. Above ground wet pipes in unheated areas noted on the drawings shall be protected from freezing by tracing with Raychem self-regulating, heat trace tape, Model 5BTV-C-CR. Heat trace tape shall be spiral wrapped as indicated on the drawings. Pipes shall then be insulated with 1" thick fiberglass insulation with all season jacket. Insulation exposed to weather shall be protected with an aluminum jacket weather sealed.

2.11 STANDPIPE CABINETS

A. General: Provide fire extinguisher cabinets where indicated, of suitable size for housing fire extinguisher of types and capacities indicated.

B. Construction:

1. Manufacturer’s standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated.
2. Weld all joints and grind smooth 3. Miter and weld perimeter door frames.

C. Cabinet Type:

1. Mounting: Suitable for mounting conditions indicated of the following types:

a. Recessed: Cabinet box (tub) fully recessed in walls of sufficient depth to suit style of trim indicated.
b. Valve and extinguisher cabinets.

D. Trim Style: Fabricate the trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

a. Square-Edge Trim: Square edges with backbend depths of 1/4” to 5/16”.

E. Trim Metal: Of same metal as door.

F. Door Material and Construction: Manufacturer’s standard door construction, of material indicated, coordinates with cabinet types and trim styles selected.

1. Aluminum: Manufacturer’s standard flush, hollow aluminum door construction.

G. Door Glazing:

1. Tempered float glass, complying with FS DD-G-1403, grade B, style I, type I, quality q3, class as indicated below:

    a. Clear, glass, class I (transparent).

H. Door Style: Manufacture's standard design as indicated below and on drawing.

1. Vertical Duo-Panel: Tempered float glass, 1/8 " thick, unless otherwise indicated.

I. Door Hardware:

1. Provide Manufacturer's standard door opening hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Anodized Aluminum Finishes: Provide architectural anodic coatings complying with following requirements:

1. Class II Clear (Natural) Anodized Finish: AA-M12C22A31 (mechanical finish, non-specular as fabricated; chemical etch, medium matte; 0.4 mil min. thick clear anodic coating).

K. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. J.L. Industries.
2. Larsen's Mfg. Co.
3. Potter-Roemer, Inc – 1800 series.

PART 3 - EXECUTION

3.1 GENERAL:

A. Unless specifically stated otherwise, the fire protection system shall conform to all other sections of this specification which apply to pipe installation, accessories and controls.

B. All threaded hose outlets shall comply with the local fire department requirements.

C. All shop drawings submitted on items requiring Underwriters' Listing shall bear evidence of Underwriters' approval.

D. All exposed fire system piping including valve room piping shall be cleaned of rust, grease and scaled and shall be provided with a field applied prime coat and two coats of an oil based enamel paint. Color shall be red or as directed by architect.

E. The contractor shall perform all tests of Fire Protection Systems as required by governing codes and local authorities at no additional cost to the Owner. Tests shall be performed in the presence of the Owners representative.

3.2 INSTALLATION:

A. Install sprinkler piping with a slope to valve room and to auxiliary low point drains as required by NFPA 13.

B. Coordinate sprinkler installation with building structure and other trades.

C. Route main drain to outside building and terminate 12" AFG.

D. Verify locations of lights and diffusers prior to installing sprinkler heads and piping.

E. Sprinkler heads shall be symmetrical to lights and diffusers in each space. Provide additional sprinkler heads as necessary to provide symmetry. Architect's representative shall final authority for location and symmetry of all sprinkler heads.

F. Sprinkler heads shall be installed on centerline with lights, diffusers and doors, in living units. In lay in tile ceiling the sprinkler heads shall be installed in the center of 2' x 2' tiles and in the center of the 1/2 tile in 2' x 4' tiles.

G. Contractor shall purge air from all wet pipe sprinkler system piping prior to final system completion.

H. Provide return bends in heated areas in order to allow for adjusting heads to centerline.

I. Install a spare sprinkler cabinet near the sprinkler riser. Provide number of spare sprinklers as required by NFPA-13, with at least one spare for each type of head installed.

3.3 PRODUCT COORDINATION

A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power driven item of equipment. The electrical design was based on the typical power requirements of the equipment manufacturers scheduled or specified. Any modifications to the electrical system which are required due to the use of an approved equivalent manufacturer shall be made at no additional cost to the owner. All changes must be clearly documented and submitted for review by the Architect/Engineer prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. The fire protection contractor shall furnish a detailed list of equipment electrical characteristics to the electrical contractor for the purpose of preparing the coordination affidavit required by Division 26.

B. Coordination of Options and Substitutions: Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface of equipment has been checked and satisfactorily established.

C. Firestopping: Refer to architectural drawings for the locations of all fire rated ceilings, floors and walls. The contractor shall furnish detailed shop drawings of all firestopping details to be used for both piping and ductwork. All firestopping details shall be U.L. listed and subject to approval by the Authority having jurisdiction.

3.4 COORDINATION OF FIRE PROTECTION INSTALLATION

A. General: Sequence, coordinate and integrate the various elements of fire protection work so that building systems will perform as indicated and be in harmony with other work of the building. The Architect/Engineer will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:

1. Install piping and similar services straight and true, aligned with other work and with overhead structures and allowing for insulation where applicable. Conceal where possible.
2. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
3. Give the right-of way to piping systems required to slope for drainage (over other service lines).
4. Piping shall be located to avoid interference with light fixtures. Give right of way to light fixtures.
5. Piping shall be located to avoid interference with duct work . coordinate with duct work installer for designed ceiling heights. Areas where both piping and duct work occur the duct work shall be given right of way.
6. Store materials off the ground and protected from standing water and weather.
7. Do not install piping systems through other trades (e.g. piping through cable tray) unless specifically noted to do so on the Drawings.

B. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of the conflict.

C. Electrical Work: Coordinate the fire protection work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install fire protection equipment ready for electrical connection. Refer to electrical sections of the specifications for electrical connection of fire protection equipment.

D. Utility Connections: Coordinate the connection of fire protection systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Provide a single connection for each service except where multiple connections are indicated.

3.5 FIRE PROTECTION IDENTIFICATION

A. Coordination: Where identification is to be applied to surfaces which require painting and other covering or finish, including valve tags in finished spaces, install identification after completion of covering or painting.

B. Piping System Identification:

1. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.

C. Locate pipe markers as follows wherever piping is exposed to view in mechanical rooms, accessible maintenance spaces (including accessible areas above ceilings) and exterior non-concealed locations:

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures. Mark each pipe at branch, where there could be a question of flow pattern.
3. Near locations where pipes pass through walls or ceilings, or enter non-accessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced intermediately at maximum spacing of 50 feet along each piping run, except reduce spacing to 25 feet in congested areas of piping and equipment.

D. Do not mark piping exposed in finished occupied spaces.

E. Fire protection Equipment Identification: Install an engraved plastic laminate sign on or near each major item of fire protection equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for all major items of fire protection equipment.

F. Valve tags shall be attached to the valve handwheel with cable ties.

END OF SECTION 21 2010

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SECTION 22 0000 GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general provisions covering the contract documents for Plumbing Systems.

1.3 DEFINITIONS

A. Provide shall mean "Furnish, install and connect."

B. Piping shall mean "pipe installed with all specified fittings, valves and accessories, and forming a complete system."

C. INFORMATIONAL SUBMITTALS

D. Electrical Coordination Drawings: In addition to submittal requirements of other Division 22, submit a document approved by the project Electrical Contractor certifying that all plumbing equipment being furnished under Division 22 complies with the electrical characteristics of the source power which will be furnished under Division 26.

E. Model numbers listed on the Plumbing Contract Documents shall not be construed to indicate electrical characteristics. Electrical characteristics of plumbing equipment shall be as indicated on the Electrical Contract Documents.

F. Review of Submittals does not relieve the Contractor of any of the requirements of the Contract Documents. Failure by the Engineer to document errors and omissions in the Contractor's submittals during the Engineer's submittal review does not constitute a waiver of any of the requirements of the original Contract Documents.

1.4 CLOSEOUT SUBMITTALS

A. Installation Instructions: Two binders containing manufacturer's installation instructions for all equipment furnished under Division 22 shall be furnished by the Contractor. One binder shall be kept in the General Contractor's office at the job site. The other binder shall be delivered to the Engineer upon acceptance by the Architect of the Submittals.

B. Operation and Maintenance Instructions: Three copies of equipment O&M manuals contained in rigid 3-ring binders shall be submitted to the Owner a minimum of 15 days prior to equipment/systems training. Binders shall have permanent labels on the spine and front cover

indicating project name, project number, building name and contents. Model and serial numbers of equipment shall be shown on the cover of their respective O&M manual(s).

1.5 QUALITY ASSURANCE

A. Plumbing Installer Qualifications:
   1. Plumbing Subcontractor shall have demonstrated proficiency in the installation of plumbing systems by the successful installation of systems similar to those included in the Construction Documents for this project. Such systems shall have been installed in commercial or institutional buildings having a minimum of 100 plumbing fixtures (in a single building). The Subcontractor shall have been in business as described above for a minimum period of five years.
   2. A master or journeyman plumber shall be present at the site during the installation of all plumbing related work. The master or journeyman plumber shall be certified in the state in which the construction is being performed and shall have his license present at site or on file during construction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Material storage
   1. All materials and equipment stored on the jobsite shall be elevated above the ground and stored under suitable weather cover. Materials and equipment shall not be stored in areas subjected to localized flooding.
   2. Manufacturer's original shipping packaging and protective coverings shall be left in place until the equipment is prepared for installation.
   3. All equipment subject to water damage shall be protected from such. No equipment shall be subject to flooding, rain and wind damage.

B. Electrical enclosure protection
   1. During construction, all protective covers and other devices shall be left in place that protect against inadvertent contact with live electrical circuits.
   2. All warning labels related to electrical and rotating equipment hazards shall be in place prior to energizing plumbing equipment circuits.

C. Protection of piping
   1. Maintain temporary closures on the ends of all piping as the installation work progresses. Temporary closures include plastic sheeting, tape and appropriate caps and covers.
   2. Where debris enters piping during installation, steps shall be taken to clean the interior of the pipe prior to placing in service.

D. Roof protection: All penetrations through roofs, including roof curbs, piping curbs and roof drainage system elements shall be properly protected during construction to prevent water intrusion into the building. Protective measures shall include temporary covers and plugs, as well as other appropriate temporary elements.

1.7 PRIOR APPROVALS

A. Manufacturers References: When reference is made in the Contract Documents to trade names or specific manufacturers and/or models, such reference, unless noted otherwise, is made to designate and identify the quality of materials or equipment to be furnished and is not intended to restrict competitive bidding. If it is desired to use materials or equipment different from those indicated on the Contract Documents, written request for approval must be received by the Architect at least TEN DAYS prior to the date set for the opening of bids. A copy of the request should also be sent directly to the Engineer. Requests for prior approval of a proposed substitute shall be accompanied by complete technical data supporting the request.

B. Request for Prior Approval by facsimile transmission (fax) will not be considered. Prior approval requests shall be submitted in hard copy or email format only.

1.8 PERMITS AND FEES

A. Obtain all necessary Permits and Inspections required for the installation of this work and pay all charges incident thereto. Deliver to the Architect all certificates of inspection issued by authorities having jurisdiction.

B. Sewer tap fees, water tap fees, meter fees, Dept. of Labor Fees for Boilers and Pressure Vessels and all other charges for work under Division 22, including charges for meter installation and excess service by the Gas Company or any other utilities shall be paid by the Contractor.

1.9 SAFETY

A. OSHA Requirements applicable to the project shall be complied with at all times.

B. Manufacturer's Safety Instructions shall be followed in all instances.

C. Asbestos Containing Materials (ACM) shall not be used on this project.

D. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch diameter sphere and shall comply with the loading requirements for guards specified in the International Building Code.

1.10 FIELD CONDITIONS

A. Electrical Equipment Clearances: Piping, equipment and other plumbing installations shall not be located within 42" of the front or 36" of the side of any electrical switchboards, panelboards, power panels, motor control centers, electrical transformers or similar electrical equipment. Piping and ductwork shall not pass through or above electrical equipment rooms except as required to serve those rooms.

B. Layout:

1. The equipment listed on the Drawings is considered basis of design equipment and has been used for the physical arrangement of the plumbing systems. When other equipment listed in the specifications as acceptable, equal or equipment which has received "prior approval" is used, it shall be the Contractor's responsibility to provide structural, ductwork, electrical, service clearances, or other changes required to accommodate the substituted equipment. Changes to use non basis of design equipment shall be made at no additional cost to the Owner. Submit a list of required changes along with all prior approval requests and shop drawing submittals.
2. The Contract Drawings are intended to show the general arrangement of all plumbing work. They do not show in detail all offsets, fittings and transitions. Examine Drawings, investigate site conditions to be encountered and arrange work accordingly. Furnish all offsets and transitions required for a complete and functional installation.
3. Drawings do not indicate in detail exact configuration of connections for fixtures, equipment and accessories. Final connection shall be as shown on approved Manufacturer's Submittal Drawings. Where Manufacturer's Submittal Drawings conflict with the Contract Documents, consult with the Architect for resolution.

C. Measurement of Drawings by scale shall not be used as dimensions for fabrication. Measurements for locating fixtures, equipment, ductwork, piping and other plumbing items shall be made on the site and shall be based on actual job site conditions.

D. Check spatial limitations and verify electrical requirements before ordering any plumbing equipment or materials. Before ordering materials or fabricating ductwork and piping, notify Architect if conflicts are detected with other building components. Place large equipment inside the building prior to the erection of exterior walls where equipment cannot enter finished building openings.

E. Coordination: Plumbing work shall be coordinated with that of other trades to avoid conflict. The Contractor shall study all plans and specifications for this project and shall notify the Architect of any conflict between work under Division 22, and work under other divisions of the Project. Particular attention shall be given to interference between piping, electrical installations, structural systems, building openings and ductwork.

F. Failure to accurately and timely coordinate with other trades for installation of plumbing systems shall not result in additional charges to the owner, architect or engineer.

1.11 CODES AND STANDARDS

A. Plumbing installations shall conform to the latest edition, or the addition approved by the authority having jurisdiction of the following, in addition to any other mentioned Codes and Standards.
1. The International Building Code.
2. The International Mechanical Code.
3. The International Plumbing Code
4. The State Energy Code
5. The International Fire Protection Code
6. NFPA Standard 13, Installation of Sprinkler Systems.
7. NFPA Standard 70, National Electric Code.
8. NFPA Standard 90A, Installation of Air Conditioning and Ventilation Systems.
9. NFPA Standard 101, Code for Safety to Life for Fire in Buildings and Structures.

1.12 INTERRUPTION OF EXISTING SERVICES

PART 2 - PRODUCTS (Not applicable for this section.)

PART 3 - EXECUTION (Not applicable for this section.)

END OF SECTION 22 0000

SECTION 22 0500 BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following basic plumbing materials and methods to complement other plumbing sections.

1. Non-shrink grout for equipment installations.
2. Fire stopping.
3. Installation requirements common to equipment specification sections.
4. Touchup painting and finishing.
5. Concrete equipment base construction requirements.
6. Demolition.
7. Cutting and Patching.

B. See individual piping sections for pipe and pipe fitting materials.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Prepare coordination drawings of Mechanical Rooms to a 1/4-inch equals 1 foot scale or larger. Detail major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:

    a. Planned piping layout, including valve and specialty locations and valve stem movement.
    b. Clearances for installing and maintaining insulation.
    c. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
    d. Equipment service connections and support details.
    e. Exterior wall and foundation penetrations.
    f. Fire-rated wall and floor penetrations.
    g. Sizes and location of required concrete pads and bases.

2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.5 QUALITY ASSURANCE

A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting plumbing and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

B. Coordinate all electrical service requirements for plumbing equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 26. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate plumbing equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where plumbing items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 GROUT

A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.2 FIRE STOPPING

A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Products: Subject to compliance with requirements, provide products by one of the following:

1. Dow Corning Corp.
2. 3M Corporation
3. General Electric Co.
4. Standard Oil Engineered Materials Co.
5. Hilti, Inc.
6. Tremco Corp.

PART 3 - EXECUTION

3.1 GROUTING

A. Install nonmetallic non-shrink grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

3.2 FIRESTOPPING

A. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials

3.3 COMMON INSTALLATION REQUIREMENTS

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of plumbing systems. Indicated locations and arrangements were used to size ductwork and pipe; and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

B. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

E. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

F. Install equipment giving right-of-way to piping systems installed at a required slope.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.
1. bases shall extend a minimum of 4" above grade and be a minimum thickness of 6".

END OF SECTION 22 0500

SECTION 22 0517-COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - (Not Applicable)

EXECUTION END OF SECTION 22 0513

SECTION 22 0517 SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Stack-sleeve fittings.
   3. Sleeve-seal systems.
   4. Sleeve-seal fittings.
   5. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products 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.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, water-stop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber water-stop collar with center opening to match piping OD.

2.5 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, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
   1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section "Sheet Metal Flashing and Trim."
   3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
   4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 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 water stop 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.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

1. Exterior Concrete Walls below Grade:
   a. Cast-iron wall sleeves Retain first subparagraph below if using sleeve-seal systems; delete if using sleeve-seal fittings.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:
   a. Cast-iron wall sleeves with sleeve-seal system. Retain first subparagraph below if using sleeve-seal systems; delete if using only galvanized-steel-pipe sleeves.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:
   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 22 0517

SECTION 22 0518 ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: split-plate, stamped-steel type with concealed hinge.
d. Bare Piping in Finished and Unfinished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 0518

SECTION 22 0519-METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.

B. Related Sections:

1. Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
2. Section "Domestic Water Piping" for water meters inside the building.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Trerice, H. O. Co.
    b. Weiss Instruments, Inc.
    c. Weksler Instruments Corp.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Back angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.

c. Weiss Instruments, Inc.
d. WIKA Instrument Corporation - USA.
e. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Sealed; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball with NPS 1/4, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.

2. Miljoco Corporation.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Liquid-filled, bimetallic-actuated type.
2. Test plug with EPDM self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:

1. Liquid-filled, bimetallic-actuated type.
2. Test plug with EPDM self-sealing rubber inserts.

C. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 120 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Liquid-filled direct-mounted, metal case.
2. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Liquid-filled direct -mounted, metal case.
2. Sealed, direct -mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Liquid-filled direct-mounted, metal case.
2. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi.

END OF SECTION 22 0519

SECTION 22 0523.12 BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61Annex G and NSF 372 .

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Hand lever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of non-thermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. One-Piece, Brass Ball Valves:

1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass or bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.

g. Stem: Brass or stainless steel.
h. Ball: Chrome-plated brass or stainless steel.
i. Port: Reduced.

B. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Stockham Valves.
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-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

2.3 BRONZE BALL VALVES

A. One-Piece, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

a. Conbraco Industries, Inc.; Apollo Valves.
b. NIBCO INC.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. American Valve 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.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. American Valve Inc.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

C. Two-Piece, Bronze Ball Valves with Regular Port and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. DynaQuip Controls.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
g. American Valve Inc.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Bronze or brass.

h. Ball: Chrome-plated brass.
i. Port: Regular.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves 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 Valves: May be provided with solder-joint ends instead of threaded ends.
2. One piece, brass ball valve.
3. One piece, bronze ball valve with bronze trim.
4. Two-piece, brass ball valves with full port and brass trim.
5. Two-piece, bronze ball valves with full port and bronze trim.

END OF SECTION 22 0523.12

.SECTION 22 0523.14 CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 6161 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 61 Annex G and NSF 372 for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.2 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Crane Valves.
b. Jenkins Valves.
c. Stockham Valves.
d. Nibco Valves
e. American Valve Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.

c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

2.3 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. American Valve, Inc.
b. Crane Valves.
c. Jenkins Valves.
d. Stockham Valves.
e. Kitz Corporation.
f. The Macomb Groups.
g. Milwaukee Valve Company.
h. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Crane Valves.
b. Jenkins Valves.
c. Stockham Valves.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. American Valve Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 500 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.

e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 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.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat or resilient-seat check valves.

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 CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Grooved-End Copper Tubing: Grooved.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves, Class 150, bronze disc with threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves, Class 250, metal seats with threaded end connections.
2. Iron swing check valves with closure control, Class 125, lever and spring with threaded end connections.
3. Iron, grooved-end swing check valves, 300 CWP.
4. Iron, center-guided check valves, Class 250, compact wafer.
5. Iron, center-guided check valves, Class 150, metal seat with threaded end connections.
6. Iron, dual-plate check valves, Class 250, metal seat with threaded end connections.
7. Iron, single-plate check valves, Class 250, resilient seat with threaded end connections.

END OF SECTION 22 0523.14

SECTION 22 0523.15 GATE VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze gate valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

2.2 BRONZE GATE VALVES

A. Class 125, NRS, Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by 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 Valves.
e. Hammond Valve.
f. Kitz Corporation.
g. The Macomb Groups.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: 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 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 Valves.
e. Hammond Valve.
f. Kitz Corporation.
g. The Macomb Groups.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: 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.

C. Class 150, RS, Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Valves.
c. Hammond Valve.
d. Kitz Corporation.
e. The Macomb Groups.
f. Milwaukee Valve Company.
g. NIBCO INC.

h. American Valve Inc.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: Bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 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.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. For Grooved-End Copper Tubing: Valve ends may be grooved.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze gate valves, Class 125, NRS with threaded ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, Class 125, OS&Y with flanged ends.

END OF SECTION 22 0523.15

SECTION 22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections:

1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

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: Pre-galvanized 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.

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 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.
g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with in turned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Galvanized or alternate rust preventing shop coating. Paint coating with two coats primer and one coat enamel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International; a subsidiary of Mueller Water Products Inc.
b. Empire Industries, Inc.
c. ERICO International Corporation.
d. Haydon Corporation; H-Strut Division.
e. NIBCO INC.
f. PHD Manufacturing, Inc.
g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: galvanized or alternate rust preventing shop coating.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. 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.

C. Insulation-Insert Material for Hot Piping: Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 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.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 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.

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. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. 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.

N. 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.

5. 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.

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 attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. 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 non-insulated 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. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. 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.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. 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.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. 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.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. 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.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

SECTION 22 0553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:

    a. Background Color: Green.
    b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Cold Water: 1-1/2 inches, round.
    b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Color:

    a. Cold Water: Natural.
    b. Hot Water: Natural.

3. Letter Color:

    a. Cold Water: Black.
    b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 0553

SECTION 22 0719 PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Sanitary waste piping exposed to freezing conditions.
4. Roof drains and rainwater leaders.
5. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section "Plumbing Equipment Insulation."

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. 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.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

2. Insulation shall comply with requirements as outlined in IECC 2015 addition

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 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. 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, provide one of the following:

    a. Pittsburgh Corning Corporation; Foamglass.
    b. Cell-U-Foam Insulation
    c. Manville.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

E. 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, provide one of the following:

    a. Aeroflex USA, Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. 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.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Friendly Feel Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of 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 Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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. 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).
2. 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 Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide 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, provide 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, provide 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, provide 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. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-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-30.
    b. Eagle Bridges - Marathon Industries; 501.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-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; Encacel.
    b. Eagle Bridges - Marathon Industries; 570.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. 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 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. 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-50 AHV2.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass 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.
    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 one of 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. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. 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).
6. 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."

2.7 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.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. 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.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and pre-sized a minimum of 8 oz./sq. yd.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

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; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.

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.

2.12 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. 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. 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 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F.

Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 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 "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 "Penetration Firestopping."

3.5 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, 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.

3.6 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.

3.7 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.

3.8 INSTALLATION OF MINERAL-FIBER 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.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. 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.

C. 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.

D. 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 "Exterior Painting" and Section "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. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

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:

1. NPS 1 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

E. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

END OF SECTION 22 0719

`SECTION 22 1116 DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1. Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.

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.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L 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. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Elkhart Products Corporation.
    b. NIBCO Inc.
    c. Viega.
    d. T-Drill

2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. 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. Description:

    a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.

b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

I. Copper-Tube, Extruded-Tee Connections:

1. Description: Tee formed in copper tube according to ASTM F 2014.

2. Mechanically formed extruded outlets shall be perpendicular to the axis of the tub run (header). The inner branch tube end shall conform to the shape of the inner curve of the run tube and shall conform to ASTM F-2014. Forming procedures shall be in accordance the tool manufacturer's recommendations.

J. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Anvil International.
b. Shurjoint Piping Products.
c. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.

3. Mechanical Couplings for Grooved-End Copper Tubing:

a. Copper-tube dimensions and design similar to AWWA C606.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating: 300 psig.

2.3 2.2 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M,
1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.4 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40.

B. PVC Socket Fittings: ASTM D 2466 for Schedule 40

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.5 PP PIPE AND FITTINGS

A. PP Pipe: ASTM F 2389, SDR 7.4.

B. PVC Socket Fittings: ASTM F 2389.

2.6 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. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.7 TRANSITION FITTINGS

A. General Requirements:

   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

   1. Manufacturers: Subject to compliance with requirements, provide products by the following:

      a. Cascade Waterworks Manufacturing.
      b. Dresser, Inc.; Piping Specialties Products.
      c. Ford Meter Box Company, Inc. (The).
      d. JCM Industries.
      e. Romac Industries, Inc.
      f. Smith-Blair, Inc.; a Sensus company.
      g. Viking Johnson.

2.8 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 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: 150 psig.
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: 150 psig.
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. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
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 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 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 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 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section "Domestic Water Piping Specialties." Refere to contract documents for water entry description.

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

E. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. 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.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping to permit valve servicing.

J. 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.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

N. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section "Domestic Water Pumps."

O. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section "Meters and Gages for Plumbing Piping."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for Plumbing Piping."

3.2 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.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section "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. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

C. Install supports for vertical steel piping every 15 feet.

3.5 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. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. 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.

3.6 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.7 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. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
   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.

3.8 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.

3.9 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. Clean non-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 procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 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.

3.11 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 22 1116

SECTION 22 1119 DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Hose bibbs.
3. Wall hydrants.
4. Flexible connectors.

B. Related Requirements:

1. Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section "Pressure Water Coolers" for water filters for water coolers.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping, and components shall comply with NSF 61Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company.
    b. IPS Corporation.
    c. LSP Products Group, Inc.
    d. Oatey.
    e. Plastic Oddities.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.4 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.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.5 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Y-pattern strainers for water on supply side of each control valve

B. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section "Rough Carpentry."

C. Install water-hammer arresters in water piping according to PDI-WH 201.

3.2 FIELD QUALITY CONTROL

A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 1119

SECTION 22 1313 FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Non-pressure and pressure couplings.
3. Cleanouts.
4. Encasement for piping.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Expansion joints and deflection fittings.
2. Backwater valves.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

C. Field quality-control reports.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's or Owner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

1. ***<u>No PVC piping shall be installed in return air plenum spaces.</u>***

B. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 T-2 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints. ***<u>Foam core piping will not be allowed.</u>***

C. PVC Pressure Piping:

1. Pipe: AWWA C900, Class 150 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 150PVC pipe with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
1. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dallas Specialty & Mfg. Co.
b. Logan Clay Pipe.
c. Mission Rubber Company; a division of MCP Industries, Inc.
d. NDS.
e. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

D. Shielded, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Mfg.
b. Dallas Specialty & Mfg. Co.
c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
3. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

E. Nonpressure-Type, Rigid Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO-Husky.
   b. CLAMPALL
   c. DALLAS SPECIALTY

2. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.3 PRESSURE-TYPE PIPE COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cascade Waterworks Mfg.
2. Dresser, Inc.
3. Ford Meter Box Company, Inc. (The); Pipe Products Div.
4. JCM Industries, Inc.
5. Romac Industries, Inc.
6. Smith-Blair, Inc.; a Sensus company.
7. Victaulic Depend-O-Lok, Inc.
8. Viking Johnson.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

C. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psig minimum pressure rating and ends of same sizes as piping to be joined.

D. Center-Sleeve Material: Manufacturer's standard

E. Gasket Material: Natural or synthetic rubber.

F. Metal Component Finish: Corrosion-resistant coating or material.

G. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of micro tunneling.

F. Install gravity-flow, non-pressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 24-inch minimum cover.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

3.2 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to the following:

1. 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.
2. Join PVC profile sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
3. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
4. Join dissimilar pipe materials with non-pressure-type, flexible or rigid couplings.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.

a. Unshielded flexible or rigid couplings for pipes of same or slightly different OD.
b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

3.3 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.4 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains specified in Section "Sanitary Waste and Vent Piping."

3.5 IDENTIFICATION

A. Comply with requirements in Section "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials,and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
    b. Option: Test concrete gravity sewer piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.7 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 22 1313

SECTION 22 1316 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
2. Section "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For solvent drainage system. Include plans, elevations, sections, and details.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's or or Owner's written permission.

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 PVC PIPE AND FITTINGS

A. Note: No PVC piping shall be allowed in return air Plenums. ***No foam core allowed***

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer 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. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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 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, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dallas Specialty & Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.
3) 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 Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cascade Waterworks Mfg. Co.
2) Dresser, Inc.
3) EBAA Iron, Inc.
4) JCM Industries, Inc.
5) Romac Industries, Inc.
6) Smith-Blair, Inc.; a Sensus company.
7) The Ford Meter Box Company, Inc.
8) Viking Johnson.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

2. Dielectric Unions:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Capitol Manufacturing Company.
        2) Central Plastics Company.
        3) Hart Industries International, Inc.
        4) Jomar International Ltd.
        5) Matco-Norca, Inc.
        6) McDonald, A. Y. Mfg. Co.
        7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
        8) Wilkins; a Zurn company.

    b. Description:

        1) Standard: ASSE 1079.
        2) Pressure Rating: 150 psig.
        3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Capitol Manufacturing Company.
        2) Central Plastics Company.
        3) Matco-Norca, Inc.
        4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
        5) Wilkins; a Zurn company.

    b. Description:

        1) Standard: ASSE 1079.
        2) Factory-fabricated, bolted, companion-flange assembly.
        3) Pressure Rating: 150 psig.
        4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Advance Products & Systems, Inc.
        2) Calpico, Inc.
        3) Central Plastics Company.
        4) Pipeline Seal and Insulator, Inc.

    b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Elster Perfection.
2) Grinnell Mechanical Products.
3) Matco-Norca, Inc.
4) Precision Plumbing Products, Inc.
5) Victaulic Company.

b. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 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 to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. 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 drainpipe. 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.

K. 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.

L. 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 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

4. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

M. Install steel piping according to applicable plumbing code.

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Install aboveground ABS piping according to ASTM D 2661.

P. Install aboveground PVC piping according to ASTM D 2665.

Q. Install underground ABS and PVC piping according to ASTM D 2321.

R. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
4. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
5. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

S. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with

closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section "Sanitary Waste Piping Specialties."

2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section "Sanitary Waste Piping Specialties."

T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for Plumbing Piping."

3.2 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 hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. 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.

D. 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 unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

G. 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.

H. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

3.4 VALVE INSTALLATION

A. General valve installation requirements are specified in Section "Ball Valves for Plumbing Piping," Section "Check Valves for Plumbing Piping," and Section "Gate Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section "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.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. 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. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 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: 12 feet with 1/2-inch rod.

6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.

2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

3. NPS 2-1/2: 108 inches with 1/2-inch rod.

4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.

K. Install supports for vertical copper tubing every 10 feet.

L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

M. Install supports for vertical ABS and PVC piping every 48 inches.

N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 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. Comply with requirements cleanouts and drain specified in Section "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and 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 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

3.8 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.

3.9 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.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 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 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 hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller 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 hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.

a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints. ***Foam core not allowed.***
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 1316

SECTION 22 1319-SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Through-penetration fires top assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

B. Related Requirements:

1. Section "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Section "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PVC: Polyvinyl chloride plastic.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Josam Company.
2) MIFAB, Inc.
3) Smith, Jay R. Mfg. Co.
4) Tyler Pipe.
5) Watts Drainage Products.
6) Zurn Plumbing Products Group.

B. Metal Floor Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Josam Company.
2) Oatey.
3) Sioux Chief Manufacturing Co., Inc.
4) Smith, Jay R. Mfg. Co.
5) Tyler Pipe.
6) Watts Drainage Products.
7) Zurn Plumbing Products Group.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. Watts Drainage Products.
   c. Zurn Plumbing Products Group; Light Commercial Operation

d. J.R. Smith

2. Standard: ASME A112.6.3.
3. Pattern: Area drain.
4. Body Material: Gray iron.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Top or Strainer Material: Bronze Top of Body and Strainer Finish: Nickel bronze
8. Top Shape: Square.
9. Top Loading Classification: Medium Duty
10. Funnel: Not required.
11. Trap Material: Cast iron
12. Trap Pattern: Standard P-trap .
13. Cleanout and Fastening Materials: As recommended by system manufacturer.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

a. Open-Top Vent Cap: Without cap.
b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ProSet Systems Inc.
b. Metacaulk
c. Hilti

2. Standard: UL 1479 assembly of sleeve and stack fitting with fire stopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hub less-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. 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.

B. 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 [1 inch] [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.

C. 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.

D. 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.

E. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

F. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

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. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Install grease interceptor on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section "Cast-in-Place Concrete." Or Section "Miscellaneous Cast-in-Place Concrete."
2. Comply with requirements of local jurisdiction for installation and placement of grease interceptor. It shall be the contractor’s responsibility for gaining approval from local jurisdiction for installation and approval for installation.

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. For cleanouts located in carpeted areas, install cleanouts with carpet markers.

F. 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.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated. Trench drain shall be part of kitchen supplier with plumber making final connections.

H. Install fixture air-admittance valves on fixture drain piping. Provide access to air-admittance valves in cabinets.

I. Install stack air-admittance valves at top of stack vent and vent stack piping.

J. Install air-admittance-valve wall boxes recessed in wall.

K. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

L. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

M. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

N. Assemble open drain fittings and install with top of hub 1 inch above floor.

O. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

P. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

Q. Install vent caps on each vent pipe passing through roof.

R. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

S. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

T. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

U. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

V. 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 "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.

C. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.

D. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

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.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Section "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.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Grease interceptors.

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 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled grease removal devices and their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 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.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices. Refer to Section "Demonstration and Training."

END OF SECTION 22 1319

SECTION 22 1429 - SUMP PUMPS

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. Packaged drainage-pump units.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

   1. Include plans, elevations, sections, and [mounting] [attachment] details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   4. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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.

2.2 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps
   1. Description: Factory-assembled and -tested sump-pump unit.
   2. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
   3. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
   4. Impeller: Statically and dynamically balanced, ASTM A48/A48M, Class No. 25 A cast iron and ASTM B584, cast bronze, design for clear wastewater handling, and keyed and secured to shaft.
   5. Pump and Motor Shaft: Stainless steel], with factory-sealed, grease-lubricated ball bearings.
   6. Seal: Mechanical.
   7. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

      a. Motor Housing Fluid: Air.

   8. Controls:

      a. Enclosure: NEMA 250,Type 4X.
      b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
      c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
      d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
      e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120 V ac, with transformer and contacts for remote alarm bell.

Controls in first subparagraph below are float- and pressure-switch types.

   9. Controls:

      a. Enclosure: NEMA 250,Type 4X; pedestal mounted.
      b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
      c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.

d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with [mechanical-float, mercury-float, or pressure] switch matching control and electric bell; 120 V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:

.

a. Remote Alarm Contacts: For remote alarm interface.
b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.
2) Alarm status.

B. Submersible, Fixed-Position, Double-Seal Sump Pumps

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM A48/A48M, Class No. 25 A cast iron, design for clear wastewater handling, and keyed and secured to shaft.
6. Pump and Motor Shaft: Stainless steel with factory-sealed, grease-lubricated ball bearings.
7. Seals: Mechanical.
8. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
9. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

a. Motor Housing Fluid: Air

10. Controls:

a. Enclosure: NEMA 250, Type 4X
b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.

.

c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120 V ac, with transformer and contacts for remote alarm bell.

11. Controls:

a. Enclosure: NEMA 250, Type 4X pedestal mounted.

b. Switch Type: Mercury-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with [mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120 V ac, with transformer and contacts for remote alarm bell.

12. Control-Interface Features:

a. Remote Alarm Contacts: For remote alarm interface.
b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.
2) Alarm status.

2.3 PACKAGED DRAINAGE-PUMP UNITS

A. Packaged Submersible Drainage-Pump Units

1. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sump-pump shall be as listed below:
2. 1. Zoller
3. 2. Pentair
4. 3. Goulds
5. 4. Liberty
6. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
7. Casing: Metal.
8. Impeller: Brass].
9. Pump Seal: Mechanical.
10. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
11. Power Cord: Three-conductor, waterproof cable of length required, but not less than 72 inches, with grounding plug and cable-sealing assembly for connection at pump.
12. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A53/A53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray-iron threaded fittings].
13. Control: Motor-mounted float switch.

B. Capacities and Characteristics:

1. Capacity: 20gpm.
2. Total Dynamic Head: 8 feet.
3. Speed: 3450 rpm.
4. Discharge Pipe Size: 2” NPS.
5. Electrical Characteristics:

a. Motor Horsepower: .5 hp.
b. Volts: 120 V.
c. Phases: Single.

d. Hertz: 60.
e. Full-Load Amperes: 10.5 A.

6. Basin: Not required.

2.4 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.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test, inspect, and adjust components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup check according to manufacturer's written instructions.

3.7 ADJUSTING

A. Adjust pumps to function smoothly,and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train] Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429

SECTION 22 3300 ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial, electric, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

B. Source quality-control reports.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Domestic-Water Booster Heaters:

1) Controls and Other Components: Five years.

b. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Three years.

3. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, domestic-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Water Heaters.
   b. Bradford White Corporation.
   c. Rheem Manufacturing Company.
   d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   e. State Industries.
   f. Vaughn

2. Standard: UL 1453.
3. Storage-Tank Construction: ASME-code, steel vertical arrangement.

   a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

2.2 Domestic-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL Inc.
b. Flexcon Industries.
c. Honeywell International Inc.
d. Pentair Pump Group (The); Myers.
e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
f. State Industries.
g. Taco, Inc.

2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charge to minimum system-operating pressure at tank.

3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Heat-Trap Fittings: ASHRAE 90.2.

D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

E. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

G. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

H. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

I. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section "Cast-in-Place Concrete." Or Section "Miscellaneous Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. 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.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section "Ball Valves for Plumbing Piping," Section "Butterfly Valves for Plumbing Piping," and Section "Gate Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section "Domestic Water Piping Specialties."

F. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."

G. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill electric, water heaters with water.

J. Charge water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section "Quality Requirements" for retesting and reinspecting requirements and Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric, domestic-water heaters.

END OF SECTION 22 3300

SECTION 22 4213.13 COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. American Standard America.
    b. Crane Plumbing, L.L.C.
    c. Kohler Co.
    d. Sloan
    e. Zurn Industries

2. Bowl:

    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    b. Material: Vitreous china.
    c. Type: Siphon jet.
    d. Style: Flushometer valve.
    e. Height: Standard and Handicap elderly complying with ICC/ANSI A117.1.
    f. Rim Contour: Elongated.
    g. Water Consumption: 1.28 gal. per flush.
    h. Spud Size and Location: NPS 1-1/2; top.
    i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.

2.2 FLUSHOMETER VALVES

A. Manually operated, Diaphragm Flushometer Valves

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Sloan Valve Company.(Owner preferred vendor. See Bid form for alternates)
    b. Zurn Industries, LLC; Commercial Brass and Fixtures.
    c. American Standard
    d. Kohler

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.

8. Style: Exposed
9. Consumption: 1.28 gal per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats - Elongated open front

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. American Standard America.
    b. Bemis Manufacturing Company.
    c. Church Seats.
    d. TOTO USA, INC.
    e. Kohler
    f. Centoco

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial Standard save
5. Shape: Elongated rim, open front.
6. Hinge Self-sustaining, check
7. Hinge Material: Noncorroding metal.
8. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

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

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Escutcheon Installation:

1. Install escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4213.13

SECTION 22 4213.16 COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Urinals.
   2. Flushometer valves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

   1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, bottom outlet, washout.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. American Standard America.
    b. Briggs Plumbing Products, Inc.
    c. Kohler Co.
    d. Mansfield Plumbing Products LLC.
    e. Zurn Industries
    f. Sloan

2. Fixture:
    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    b. Material: Vitreous china.
    c. Drain: Separate removable chrome-plated dome strainer with chrome-plated, NPS 1-1/2 tailpiece.
    d. Strainer or Trap way: Manufacturer's standard strainer and NPS 1-1/2 tailpiece.
    e. Design Consumption:1.0 gpm
    f. Inlet Spud Size and Location: NPS 3/4; top.
    g. Outlet Size and Location: NPS 1-1/2; bottom.
    h. Color: White.

3. Waste Fitting:
    a. Standard: ASME A112.18.2/CSA B125.2.
    b. Trap:
        1) Size: NPS 1-1/2.
        2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or steel wall flange.
        3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

4. Support: ASME A112.6.1M, Type II, urinal carrier with hanger and bearing plates
5. fixture bolts and hardware matching fixture

2.2 URINAL FLUSHOMETER VALVES

1. Manually operated Diaphragm Flushometer Valves. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Sloan Valve Company. (Owner preferred vendor. See Bid form for alternates)
    b. American Standard
    c. Kohler
    d. Zurn Industries.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.

7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed
9. Consumption 1.0. per flush.
10. Minimum Inlet: NPS 3/4
11. Minimum Outlet: NPS 1-1/4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

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

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.

D. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 0518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4213.16

SECTION 22 - 4216.13 COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 GENERAL

2.2 ENAMELED, CAST-IRON, WALL-MOUNTED LAVATORIES

A. Lavatory: Rectangular, enameled, cast iron, wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. American Standard America.
b. Commercial Enameling Company.
c. Gerber Plumbing Fixtures LLC.
d. Kohler Co.
e. Sloan

2. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2.
b. Type: Straight-front apron with straight back.
c. Nominal Size: Rectangular, 20x18 inches. Coordinate with architectural drawings to ensure proper size.
d. Faucet-Hole Punching: As noted on contract documents.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Wall bracket.

3. Faucet: Solid-Brass, Manually Operated Faucets

4. Waste Fittings: Comply with requirements in "Waste Fittings.:

2.3 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, **t**wo-handle mixing commercial solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. American Standard America.
    b. Bradley Corporation.
    c. Chicago Faucets.
    d. Delta Faucet Company.
    e. Elkay Manufacturing Co.
    f. Grohe America, Inc.
    g. Just Manufacturing.
    h. Kohler Co.
    i. Moen Incorporated.
    j. Speakman Company.
    k. T & S Brass and Bronze Works, Inc.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor. If hot water not specified, provide cw to both sides of faucet.
4. Body Type: Refer to contract documents for faucet placement.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Mounting Type: Deck, exposed 4 inch wrist blade handle.
9. Spout: Rigid type.
10. Spout Outlet: Aerator
11. Operation: Compression, manual
12. Drain: Not part of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 1/2.

2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

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

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. 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 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section "Plumbing Piping Insulation."

3.3 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 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216.13

SECTION 22 4216.16 COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Service sinks.
   2. Utility sinks.
   3. Sink faucets.
   4. Supply fittings.
   5. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
   2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins: Terrazzo, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Acorn Engineering Company.
    b. Crane Plumbing, L.L.C.
    c. Florestone Products Co., Inc.
    d. Stern-Williams Co., Inc.
    e. Fiat Products

2. Fixture:

    a. Standard: IAPMO PS 99.
    b. Shape: Square.
    c. Nominal Size: as indicated on contract documents. Coordinate with Architectural.
    d. Height:10 inches.
    e. Tiling Flange: Not required
    f. Rim Guard: On front top surfaces.
    g. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet: Wall mounted chrome plated with vacuum breaker and lever handles.

2.2 UTILITY SINKS

A. Utility Sinks: Stainless steel, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Advance Tabco.
    b. Eagle Group; Foodservice Equipment Division.
    c. Elkay Manufacturing Co.
    d. Griffin Products, Inc.
    e. Just Manufacturing.
    f. Dayton
    g. Franke

2. Fixture:

    a. Standard: ASME A112.19.3/CSA B45.4.
    b. Type: Drop in stainless steel.
    c. Number of Compartments: One and two compartments as shown on contract documents and fixture schedule

d. Overall Dimensions: as outlined on contract documents and fixture schedule
e. Metal Thickness: 0.050 inch.
f. Compartment:

1) Dimensions: As outlined on fixture schedule
2) Drain: Grid with NPS 1-1/2 tailpiece and twist drain with stopper.
3) Drain Location: Centered in compartment.

1. Faucet(s): Manufacturers: Subject to compliance with requirements, provide products by the following:

a. T&S Brass.
b. American Standard
c. Kohler
d. Number Required: one
e. Mounting: On sink ledge

2. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.
2) Risers: NPS 1/2, chrome-plated, rigid-copper pipe

3. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):

1) Size: NPS 1-1/2
2) Material: Chrome-plated, wo-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

c. Continuous Waste:

1) Size: NPS 1-1/2
2) Material: Chrome-plated, 0.032-inch- thick brass tube.

4. Mounting: On counter with sealant.

2.3 Classroom Sinks

A. Classroom Sinks: Stainless steel, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Advance Tabco.
b. Eagle Group; Foodservice Equipment Division.
c. Elkay Manufacturing Co.
d. Griffin Products, Inc.
e. Just Manufacturing.
f. Dayton
g. Just

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Ledge back.
c. Number of Compartments: One compartment as shown on contract documents and fixture schedule.
d. Overall Dimensions: as outlined on contract documents and fixture schedule.
e. Metal Thickness: 0.050 inch.
f. Compartment: one
g. Bubbler
h. Lever gooseneck faucet.

1) Dimensions: As outlined on fixture schedule
2) Drain: Grid with NPS 1-1/2 tailpiece and twist drain with stopper.
3) Drain Location: Centered in compartment.

3. Faucet(s):

a. Number Required: one
b. Mounting: On ledge.
c. Bubbler Required; one
d. Mounting: on ledge

4. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.
2) Risers: NPS 1/2, chrome-plated, rigid-copper pipe

5. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):

1) Size: NPS 1-1/2
2) Material: Chrome-plated, wo-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

c. Continuous Waste:

1) Size: NPS 1-1/2
2) Material: Chrome-plated, 0.032-inch- thick brass tube.

6. Mounting: On counter with sealant.

2.4 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets Classroom: Manual type, Single lever with rigid goose neck faucet and bubbler.

1. Commercial, Solid-Brass Faucets.

a. Manufacturers: Subject to compliance with requirements, provide products by the following:
1) Chicago Faucets.
2) Delta Faucet Company.
3) Elkay Manufacturing Co.
4) GROHE America, Inc.
5) Just Manufacturing.
6) Kohler Co.
7) Moen Incorporated.
8) Speakman Company.
9) T & S Brass and Bronze Works, Inc.
10) Zurn Plumbing Products Group.

2. General-Duty Work sinks and Kitchen sinks, Solid-Brass Faucets.

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) American Standard America.
2) Bradley Corporation.
3) Chicago Faucets.
4) Delta Faucet Company.
5) Eljer, Inc.
6) Elkay Manufacturing Co.
7) Just Manufacturing.
8) Kohler Co.
9) Speakman Company.
10) T & S Brass and Bronze Works, Inc.
11) Zurn Plumbing Products Group.

3. Copper- or Brass-Underbody Faucets.

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) American Standard America.
2) Briggs Plumbing Products, Inc.
3) Danze, Inc.
4) Delta Faucet Company.
5) Eljer, Inc.
6) Ferguson Enterprises, Inc.
7) Gerber Plumbing Fixtures LLC.
8) Matco-Norca.
9) Moen Incorporated.
10) Sterling.
11) WhiteRock Corp.
12) Wolverine Brass, Inc.

4. Standard: ASME A112.18.1/CSA B125.1.
5. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
6. Body Type: Centerset.
7. Body Material: Commercial, solid brass
8. Finish: Chrome plated.
9. Maximum Flow Rate: 2.2 gpm.
10. Handle(s): Lever.
11. Mounting Type: Deck
12. Swing, round tubular spout
13. Vacuum Breaker: Not required for hose outlet.
14. Spout Outlet: Aerator.

2.5 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 1/2

2. Chrome-plated, rigid-copper pipe

2.6 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall]; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

2.7 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, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

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

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. 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 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and 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 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks 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 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216.16

SECTION 22 4716 PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 2 of each.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers: Wall mounted standard and wheelchair accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Elkay Manufacturing Co.
    b. Halsey Taylor.
    c. Haws Corporation.
    d. Murdock

2. Cabinet: Single all stainless steel with stainless-steel top.
3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
4. Bottle Filler on water coolers identified on contract documents.
5. Control: Push bar.
6. Drain: Grid with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

11. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.

12. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section "Joint Sealants."

3.3 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 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture.[Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4716

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SECTION 23 0000 - GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general provisions covering the contract documents for HVAC Systems.

1.3 DEFINITIONS

A. Provide shall mean "Furnish, install and connect."

B. Piping shall mean "pipe installed with all specified fittings, valves and accessories, and forming a complete system."

C. HVAC shall mean "Heating, Ventilation and Air Conditioning."

1.4 INFORMATIONAL SUBMITTALS

A. Electrical Coordination Drawings: In addition to submittal requirements of other Division 23 Sections, submit a document approved by the project Electrical Contractor certifying that all mechanical equipment being furnished under Division 23 complies with the electrical characteristics of the source power which will be furnished under Division 26.

B. Model numbers listed on the Mechanical Contract Documents shall not be construed to indicate electrical characteristics. Electrical characteristics of mechanical equipment shall be as indicated on the Electrical Contract Documents.

C. Review of Submittals does not relieve the Contractor of any of the requirements of the Contract Documents. Failure by the Engineer to document errors and omissions in the Contractor's submittals during the Engineer's submittal review does not constitute a waiver of any of the requirements of the original Contract Documents.

1.5 CLOSEOUT SUBMITTALS

A. Installation Instructions: Two binders containing manufacturer's installation instructions for all equipment furnished under Division 23 shall be furnished by the Contractor. One binder shall be kept in the General Contractor's office at the job site. The other binder shall be delivered to the Engineer upon acceptance by the Architect of the Submittals.

B. Operation and Maintenance Instructions: Three copies of equipment O&M manuals contained in rigid 3-ring binders shall be submitted to the Owner a minimum of 15 days prior to equipment/systems training. Binders shall have permanent labels on the spine and front cover indicating project name, project number, building name and contents. Model and serial numbers of equipment shall be shown on the cover of their respective O&M manual(s).

1.6 QUALITY ASSURANCE

A. HVAC Installer Qualifications:

1. HVAC Subcontractor shall have a current Class II Conditioned Air Contractors License for the state in which the project is being constructed. The Subcontractor shall have as part of the Firm a Service Department qualified to service all systems installed in the project, or have a written agreement with a Service Agency qualified to provide such service. The Service Department or Agency shall be on call at all hours.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Material storage

1. All materials and equipment stored on the jobsite shall be elevated above the ground and stored under suitable weather cover. Materials and equipment shall not be stored in areas subjected to localized flooding.
2. Manufacturer’s original shipping packaging and protective coverings shall be left in place until the equipment is prepared for installation.

B. Electrical enclosure protection

1. During construction, all protective covers and other devices shall be left in place that protect against inadvertent contact with live electrical circuits.
2. All warning labels related to electrical and rotating equipment hazards shall be in place prior to energizing mechanical equipment circuits.

C. Protection of ductwork and piping

1. Maintain temporary closures on the ends of all ductwork and piping as the installation work progresses. Temporary closures include plastic sheeting, tape and appropriate caps and covers.
2. Where debris enters piping during installation, steps shall be taken to clean the interior of the pipe prior to placing in service.
3. Where debris enters ductwork during installation the duct interior shall be cleaned prior to placing in service.
4. All lined ductwork shall be kept clean and dry. Any lined duct must be removed from the job site if moisture is discovered in installed or stored ductwork.

D. Roof protection: All penetrations through roofs, including roof curbs, piping curbs and roof drainage system elements shall be properly protected during construction to prevent water intrusion into the building. Protective measures could include temporary covers and plugs, as well as other appropriate temporary elements.

1.8 PRIOR APPROVALS

A. Manufacturers References: When reference is made in the Contract Documents to trade names or specific manufacturers and/or models, such reference, unless noted otherwise, is made to designate and identify the quality of materials or equipment to be furnished and is not intended to restrict competitive bidding. If it is desired to use materials or equipment different from those indicated on the Contract Documents, written request for approval must be received by the Architect at least TEN DAYS prior to the date set for the opening of bids. A copy of the request should also be sent directly to the Engineer. Requests for prior approval of a proposed substitute shall be accompanied by complete technical data supporting the request.

B. Request for Prior Approval by facsimile transmission (fax) will not be considered. Prior approval requests shall be submitted in hard copy or email format only.

1.9 PERMITS AND FEES

A. Obtain all necessary Permits and Inspections required for the installation of this work and pay all charges incident thereto. Deliver to the Architect all certificates of inspection issued by authorities having jurisdiction.

1.10 SAFETY

A. OSHA Requirements applicable to the project shall be complied with at all times.

B. Manufacturer's Safety Instructions shall be followed in all instances.

C. Asbestos Containing Materials (ACM) shall not be used on this project.

D. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21 inch diameter sphere and shall comply with the loading requirements for guards specified in the International Building Code.

1.11 ENVIRONMENT

A. Refrigerants containing CFC’s or HCFS’s shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

1.12 FIELD CONDITIONS

A. Electrical Equipment Clearances: Piping, equipment and other mechanical installations shall not be located within 42" of the front or 36" of the side of any electrical switchboards, panelboards, power panels, motor control centers, electrical transformers or similar electrical

equipment. Piping and ductwork shall not pass through or above electrical equipment rooms except as required to serve those rooms.

B. Layout:

1. The equipment listed on the Drawings is considered basis of design equipment and has been used for the physical arrangement of the mechanical systems. When other equipment listed in the specifications as acceptable, equal or equipment which has received "prior approval" is used, it shall be the Contractor's responsibility to provide structural, ductwork, electrical, service clearances, or other changes required to accommodate the substituted equipment. Changes to use non basis of design equipment shall be made at no additional cost to the Owner. Submit a list of required changes along with all prior approval requests and shop drawing submittals.
2. The Contract Drawings are intended to show the general arrangement of all mechanical work. They do not show in detail all offsets, fittings and transitions. Examine Drawings, investigate site conditions to be encountered and arrange work accordingly. Furnish all offsets and transitions required for a complete and functional installation.
3. Drawings do not indicate in detail exact configuration of connections for fixtures, equipment and accessories. Final connection shall be as shown on approved Manufacturer's Submittal Drawings. Where Manufacturer's Submittal Drawings conflict with the Contract Documents, consult with the Architect for resolution.

C. Measurement of Drawings by scale shall not be used as dimensions for fabrication. Measurements for locating fixtures, equipment, ductwork, piping and other mechanical items shall be made on the site and shall be based on actual job site conditions.

D. Check spatial limitations and verify electrical requirements before ordering any mechanical equipment or materials. Before ordering materials or fabricating ductwork and piping, notify Architect if conflicts are detected with other building components. Place large equipment inside the building prior to the erection of exterior walls where equipment cannot enter finished building openings.

E. Coordination: Mechanical work shall be coordinated with that of other trades to avoid conflict. The Contractor shall study all plans and specifications for this project and shall notify the Architect of any conflict between work under Division 23 and work under other divisions of the Project. Particular attention shall be given to interference between piping, electrical installations, structural systems, building openings and ductwork.

F. Failure to accurately and timely coordinate with other trades for installation of mechanical systems shall not result in additional charges to the owner, architect or engineer.

1.13 CODES AND STANDARDS

A. Mechanical installations shall conform to the latest edition or the addition approved by the authority having jurisdiction of the following, in addition to any other mentioned Codes and Standards.

1. The International Building Code.
2. The International Mechanical Code.
3. The International Plumbing Code

4. The State Energy Code
5. The International Fire Protection Code
6. NFPA Standard 13, Installation of Sprinkler Systems.
7. NFPA Standard 70, National Electric Code.
8. NFPA Standard 90A, Installation of Air Conditioning and Ventilation Systems.
9. NFPA Standard 101, Code for Safety to Life for Fire in Buildings and Structures.

1.14 USE OF MEHCANICAL SYSTEMS DURING CONSTRUCTION

A. The operation of the permanent HVAC systems during the construction process is strongly discouraged. However, the Contractor may take measures to protect the systems from contamination if they are operated.

B. Under no circumstances shall the HVAC system be operated while sanding of any kind is taking place on the jobsite.

C. When placed in operation during the construction period, all HVAC systems shall have MERV 8 filtration in all standard filter racks throughout the systems. Where so equipped, final filter banks do not have to be in place.

D. All return openings and outdoor air intake openings shall be protected with MERV 8 filter material at all points of entry into the duct system. These protections shall be maintained and remain in place until the building is prepared for final inspection. Failure to comply will result in contractor being required to clean ductwork prior to final acceptance.

E. The interior of all HVAC units shall be thoroughly cleaned to “like-new” condition prior to final acceptance of the building HVAC systems. New, clean filters shall be furnished in all new equipment.

1.15 INTERRUPTION OF EXISTING SERVICES

A. Exercise care so as not to cut any existing utilities or services. Where an existing utility line or service line is cut it shall be repaired to "like-new" condition. Interruption of service shall not be made without prior written permission of the Owner.

PART 2 - PRODUCTS (Not applicable for this section.)

PART 3 - EXECUTION (Not applicable for this section.)

END OF SECTION 23 0000

SECTION 23 0500 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following basic mechanical materials and methods to complement other mechanical sections.

1. Non-shrink grout for equipment installations.
2. Fire stopping.
3. Installation requirements common to equipment specification sections.
4. Touchup painting and finishing.
5. Concrete equipment base construction requirements.
6. Cutting and Patching.

B. See individual piping sections for pipe and pipe fitting materials.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Prepare coordination drawings of Mechanical Rooms to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:

    a. Planned piping layout, including valve and specialty locations and valve stem movement.
    b. Planned duct systems layout, including elbow radii and duct accessories.
    c. Clearances for installing and maintaining insulation.
    d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
    e. Equipment service connections and support details.
    f. Exterior wall and foundation penetrations.
    g. Fire-rated wall and floor penetrations.
    h. Sizes and location of required concrete pads and bases.

2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.5 QUALITY ASSURANCE

A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

B. Coordinate all electrical service requirements for mechanical equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 16. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

2.2 FIRE STOPPING

A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Products: Subject to compliance with requirements, provide products by one of the following:

1. Dow Corning Corp.
2. 3M Corporation
3. General Electric Co.
4. Standard Oil Engineered Materials Co.
5. Hilti, Inc.
6. Tremco Corp.

PART 3 - EXECUTION

3.1 GROUTING

A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

3.2 FIRESTOPPING

A. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials

3.3 COMMON INSTALLATION REQUIREMENTS

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of mechanical systems. Indicated locations and arrangements were used to size ductwork and pipe; and calculate friction loss, expansion, pump sizing, and other design considerations. Install ductwork and piping as indicated, except where deviations to layout are approved on coordination drawings.

B. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

E. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

F. Install equipment giving right-of-way to piping systems installed at a required slope.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.

3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inchcenters around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive strength concrete with 6 x 6 x #10 reinforcing wire mesh.
8. Outdoor concrete bases shall extend a minimum of 4" above grade and be a minimum thickness of 6".

END OF SECTION 23 0500

SECTION 23 0512 - MOTOR CONTROLLERS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes ac motor control devices for mechanical equipment that are supplied as enclosed units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions, dimensions of individual components and profiles.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Maintain, within 150 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Comply with NFPA 70.

C. Comply with UL 508 and 508A

D. Comply with NEMA ICS-2, 2000

E. Comply with IEC 60947-5, 60947-4, 60947-3

F. Listing and Labeling: Provide motor controllers specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.7 COORDINATION

A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

1.8 WARRANTY

A. Manufacturer shall provide a five year warranty on the complete starter assembly for single phase starters and magnetic motor controllers.

B. The complete VFD shall be warranted by the manufacturer for a period of 18 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer and not a third party. A written warranty statement shall be provided with the submittals.

C. The manufacturer shall offer an optional, extended warranty allowing the VFD warranty to be extended to from 36 months up to 6 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Single Phase Starters and Magnetic Motor Controllers:

a. ABB
b. Allen-Bradley Co.; Industrial Control Group.
c. Cerus Industrial
d. Cutler-Hammer Products.
e. Danfoss Graham
f. General Electric
g. Siemens Energy & Automation, Inc.
h. Square D.

2. Variable Frequency Drives

a. ABB
b. Allen-Bradley Co.; Industrial Control Group.
c. Cutler-Hammer Products.
d. Danfoss Graham
e. General Electric
f. Honeywell
g. Siemens Energy & Automation, Inc.
h. Square D.
i. Toshiba
j. Yaskawa

2.2 SINGLE PHASE STARTER

A. Description: Starters for 115VAC single phase motors less than 1 HP shall be capable of both manual and automatic operation.

B. NEMA ICS 2, general purpose, Class A.

C. The single phase motor starter shall consist of a manually operated quick-make toggle mechanism lockable in the "Off" position which shall also function as the motor disconnect. Additionally, the starter shall provide thermal overload protection, run status pilot light and fault pilot light. The starter must include the capability to operate in both manual and automatic control modes. In automatic mode, the starter shall have the capability to integrate with a building automation system by providing terminals for run input, run status output and fault output. All control terminals shall be integrated in the starter. At a minimum, each single phase starter shall include an interposing run relay and current sensing status output relay. Single phase motor starter shall be in a surface mount enclosure.

D. Starters for single phase motors not automatically started shall be manual type with thermal protection.

2.3 MAGNETIC MOTOR CONTROLLERS

A. GENERAL

1. Combination starters shall be furnished for all three phase motors, (unless specifically noted otherwise) and single phase motors which are automatically started.
2. Starters shall be NEMA type and shall provide protection on all three phases.
3. Combination Starters: Provide combination magnetic starters for all motors requiring branch circuit protection or a line-of-sight disconnect in addition to starter.

B. ENCLOSED FULL VOLTAGE NON-REVERSING (FVNR) NON-COMBINATION STARTER

1. Magnetic Motor Starters shall be enclosed in a general purpose electrical enclosure with the appropriate environmental rating.
2. Starters shall consist of a horsepower rated magnetic contactor with a minimum of 2NO and 2NC auxiliary contacts and solid state electronic overload relay.

3. Overload relay shall protect all three phases with a wide range 1-40 amp current setting and trip class to allow field adjustment for specific motor FLA. Interchangeable heater elements are not acceptable.
4. Overload relay shall incorporate SmartStart Technology, or the following protective functions:

    a. Out of calibration protection (if the FLA on the overload is set outside acceptable range, overload will trip to indicate fault event)
    b. Stall protection
    c. Max time to start
    d. Locked Rotor
    e. Phase Unbalance
    f. Phase loss
    g. Cycle Fault

5. Starter shall be field selectable for manual or auto reset to restore normal operation after a trip or fault condition. Manual pushbutton shall be accessible without removing or opening cover on starter.
6. In the event of a power failure, starter shall restart in last mode.
7. All starters must be provided with a universal power supply capable of a 208 to 600 volt input range. The power supply must accept the available line voltage and the control voltage shall not exceed 24V.
8. Installed accessories shall include Hand-Off-Auto operation pushbutton keypad. Include LED pilot light indicators for Hand, Off, Auto, Run and Overload conditions.
9. When remotely controlled by an automation system, the starter shall include remote run terminals which accept both a voltage input signal and a contact closure. The voltage run input shall accept both AC and DC signals from 12-250V to allow direct connection of the transistorized automation signal to the starter.
10. Starter must contain an integral current sensor with NO contact which closes to indicate motor run status as well as a NO contact which closes when an overload trip condition occurs.
11. Each starter shall have an individual control circuit transformer, line voltage primary, 120 volt secondary, with one fuse in the ungrounded side of the secondary. The transformer shall have 100% space capacity. Where electrical interlocking is involved, a separate contact on the circuit breaker disconnect shall open the interlock circuit. All sources of power to each combination starter shall be deenergized when the lockable circuit breaker disconnect is opened.

C. ENCLOSED FULL VOLTAGE NON-REVERSING (FVNR) COMBINATION STARTER

A. Enclosed combination starters shall include all of the magnetic starter requirements in addition to a disconnecting method. All disconnects shall include a lock-out mechanism when in the off position.
B. Motor circuit protectors (MCP) shall be provided as the acceptable form of disconnecting means. The MCP shall be a UL listed 508 current limiting manual motor starter with magnetic trip elements only. The MCP shall carry a UL 508F rating (up to 100A frame size) which provides for coordinated short circuit rating for use with the motor contactor and provides a minimum interrupting rating of 30,000 AIC for the combination starter.

2.4 VARIABLE FREQUENCY DRIVES (VFD'S)

A. General:

1. The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating. When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
2. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.
3. The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable.
   VFDs with saturating (non-linear) DC link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.
4. The VFD's full load output current rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.
5. The VFD shall provide full motor torque at any selected frequency from 20 Hz to base speed while providing a variable torque V/Hz output at reduced speed. This is to allow driving direct drive fans without high speed derating or low speed excessive magnetization, as would occur if a constant torque V/Hz curve was used at reduced speeds. Breakaway current of 160% shall be available.
6. A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.
7. The VFD must be able to produce full torque at low speed to operate direct drive fans.
8. Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.
9. An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.
10. Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.
11. VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.
12. All VFDs shall contain integral EMI filters to attenuate radio frequency interference conducted to the AC power line.

B. Protective Features:

1. A minimum of Class 20 I^2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.
2. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.
3. Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.
4. Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.
5. Protect from over voltage. The VFD shall continue to operate without faulting with a momenary input voltage as high as 130% of the nominal voltage.
6. The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.
7. VFD shall include a “signal loss detection” algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.
8. VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.
9. VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.
10. Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.
11. VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.
12. If the temperature of the VFD’s heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD’s temperature becomes too high.
13. In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.
14. The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.
15. The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.
16. When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.

C. Interface Features

1. Hand, Off and Auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.
2. There shall be an “Info” key on the keypad. The Info key shall include “on-line” context sensitive assistance for programming and troubleshooting.
3. The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in Hand or Auto mode. This is to alert the Building Automation System whether the VFD is being controlled locally or by the Building Automation System.
4. Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.
5. All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.
6. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD’s keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.
7. Display shall be programmable to communicate in multiple languages including English, Spanish and French.
8. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
9. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual Fan, Pump, and Compressor menus specifically designed to facilitate start-up of these applications.
10. Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, among others.
11. Programmable Sleep Mode shall be able to stop the VFD. When its output frequency drops below set “sleep” level for a specified time, when an external contact commands that the VFD go into Sleep Mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD’s speed is being controlled by its PID controller, it shall be possible to program a “wake-up” feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.
12. A run permissive circuit shall be provided to accept a “system ready” signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output “run request” signal to indicate to the external equipment that the VFD has received a request to run.
13. VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (°F).
14. VFD shall be programmable to sense the loss of load. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.
15. Standard Control and Monitoring Inputs and Outputs

a. Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
b. Two terminals shall be programmable to act as either as digital outputs or additional digital inputs.
c. Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status. Each relay shall have an adjustable on delay / off delay time.
d. Two programmable analog inputs shall be provided that can be either direct-or-reverse acting. Each shall be independently selectable to be used with either an analog voltage or current signal. The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.
e. A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise. The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting.
f. One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.
g. It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.
h. It shall be possible to command all digital and analog output through the serial communication bus.

16. Standard programmable firefighter's override mode allows a digital input to control the VFD and override all other local or remote commands. It shall be possible to program the VFD so that it will ignore most normal VFD safety circuits including motor overload. The VFD shall display FIREMODE whenever in firefighter's override mode. Firemode shall allow selection of forward or reverse operation and the selection of a speed source or preset speed, as required to accommodate local fire codes, standards and conditions.
17. A real-time clock shall be an integral part of the VFD. It shall be possible to use this to display the current date and time on the VFD's display. Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. Is shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule. All VFD faults shall be time stamped to aid troubleshooting. It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours. The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.
18. The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.

D. Serial Communications

1. The VFD shall include a standard EIA-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:

a. BACnet MS/TP
b. Johnson Controls Metasys N2
c. Modbus RTU
d. Siemens FLN

2. Option boards for the following protocols shall be available:

a. LonWorks Free Topology (FTP) certified to LonMark standard 3.3

3. VFD shall have standard USB port for direct connection of Personal Computer (PC) to the VFD. The manufacturer shall provide no-charge PC software to allow complete setup and access of the VFD and logs of VFD operation through the USB port. It shall be possible to communicate to the VFD through this USB port without interrupting VFD communications to the building management system.
4. The VFD shall have provisions for an optional 24 V DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.

E. Adjustments

1. The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 kHz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.
2. Four independent setups shall be provided.
3. Four preset speeds per setup shall be provided for a total of 16.
4. Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.
5. Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.
6. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.
7. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
8. An automatic "start delay" may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.
9. Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.

F. Optional Features

1. All optional features shall be built, mounted and tested by the VFD manufacturer. The VFD manufacture's warranty shall apply to the entire assembly as shipped. Packages built by third parties and do not carry the VFD manufacture's warranty shall not be allowed. All options shall carry a UL / C-UL Enclosed Industrial Control Panel label.

2. All panels shall be marked for 100,000 amp short circuit current rating.
3. The enclosure rating of the VFD w/ options shall be consistent with the VFD rating of either NEMA/UL type 1, NEMA/UL type 3R or NEMA/UL type 12, as required for the installation location and/or as called for on the schedule. The package shall include ALL optional devices and shipped as a complete factory tested assembly.
4. Three-Contactor bypass shall be provided that allows operation of the motor via line power in the event of a failure of the VFD. Motor control selection shall be though either a VFD output contactor or a bypass contactor that are electrically interlocked to ensure that both contactors are not energized simultaneously. A third contactor, the drive input contactor, shall be supplied as standard. This allows the powering of the VFD with the motor off or operating in bypass mode for testing, programming and troubleshooting purposes.
5. The Three-Contactor bypass shall include the following interface and control features:

    a. Mode selection via a four position DRIVE/OFF/BYPASS/TEST switch. DRIVE Mode: Both the drive input and output contactors are closed and the motor is operated via VFD power. OFF mode: DRIVE input, drive output and bypass contactors are all open. Bypass mode: Bypass contactor is closed and motor is operating from line power. Both the drive input and drive output contactors are open for servicing of the VFD without power. Test mode: Bypass contactor is closed and the motor is operated from line power. The drive input contactor is closed but the drive output contactor is open. This allows for the testing and programming of the VFD while the motor is operated via line power.
    b. Contactors shall operate from a 24vdc power supply that shall function off of any two legs of the AC line and shall maintain power on the loss of any one of the AC lines.
    c. A Bypass pilot light is supplied to indicate that the motor is operating from line power.
    d. Common start/stop command when operating in either Bypass or VFD mode.
    e. Selectable Run Permissive logic shall operate in either VFD or bypass operation. When activated, any command to start the motor, in either Hand Bypass, Remote Bypass, Hand VFD or Remote VFD shall not start the motor, but instead close a relay contact that is used to initiate operation of another device, such as an outside air damper. A contact closure from this device shall confirm that it is appropriately actuated and the motor shall then start.
    f. Bypass package shall include an External Safety interlock that will disable motor operation in either bypass or VFD when open.
    g. Firemode bypass operation shall be standard. When activated via a contact closure, the motor shall transfer to bypass (line power) regardless of the mode selected. All calls to stop the motor shall be ignored. These include the opening of the start command, an external safety trip or the tripping of the motor overload. Firemode operation will take precedence over all other commands.
    h. The bypass must include a selectable time delay of 0 to 60 seconds before the initiation of bypass operation. When transferring from VFD to bypass modes, the time delay starts after the motor has decelerated to zero speed. This delay allows the BAS to prepare for bypass operation. Bypass packages that do not include a time delay, or do not include a selectable delay period, will not be acceptable.
    i. Automatic bypass shall be selectable. When active, the motor shall be transferred to line power on a VFD fault condition. The bypass time delay shall be activate prior to this transfer to line power to allow the VFD time to attempt to recover from the fault condition prior to running in bypass.

6. Protective features

   a. Main input disconnect shall be provided that removes power from both the bypass and VFD.
   b. Main input motor rated circuit breaker or fuses that protect the entire package.
   c. VFD only fast acting input fuses shall be provided. Packages that include only main input motor rated fusing or circuit breaker are not acceptable.
   d. Overload protection shall be supplied in bypass mode. This overload shall supply minimum class 20 protection as well as wide adjustable current setting for complete motor protection when operating on line power. Those overloads that are not class 20 or current selectable will not be acceptable. Overload protection shall include phase loss and phase imbalance protection.
   e. Low voltage contactor operation shall be maintained to 70% the of packages nominally rated voltage. This will ensure VFD operation on low voltage conditions that would otherwise be interrupted due to contactor dropout.
   f. The VFD shall be able to operate the motor at a reduced load with the loss of any one of the three phases of power. Contactors shall remain closed regardless of which phase is lost. This will ensure VFD operation on single phase conditions that would otherwise be interrupted due to contactor dropout.

7. Line/load conditioners

   a. VFDs that do not include 5% DC link impedance shall include 5% AC line reactors in the options enclosure. Lower levels of impedance will not be acceptable.
   b. When the installation requires additional motor dV/dT protection it shall be via a dV/dT filter mounted in the options enclosure. Packages that include only load reactors or filters supplied separately will not be accepted.

2.5 ENCLOSURES

A. Description: Flush or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.6 SERVICE CONDITIONS

A. Ambient temperature, continuous, full speed, full load operation:

1. 14 to 113°F through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt
2. 14 to 104°F 150 HP and larger

B. 0 to 95% relative humidity, non-condensing.

C. Elevation to 3,300 feet without derating.

D. AC line voltage variation, -10 to +10% of nominal with full output.

E. No side clearance shall be required for cooling.

F. All power and control wiring shall be done from the bottom.

2.7 ACCESSORIES

A. Devices are factory installed in controller enclosure, unless otherwise indicated.

B. Pilot Lights and "Hand-Off-Auto" Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break push-button station with a factory-applied hasp arranged so a padlock can be used to lock push button in depressed position with control circuit open.

D. Factory mounted with Nationally Recognized Testing Laboratory listed and labeled mounting device.

PART 3 - EXECUTION

3.1 PREPARATION

A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

C. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.

D. Hand-Off-Automatic Selector Switches: In covers of controllers of motors started and stopped by automatic controls or interlocked with other equipment. Also, furnish "run" light in cover.

3.2 GENERAL INSTALLATION

A. Install independently mounted motor-control devices according to manufacturer's written instructions.

B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.

C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Division 26 Sections.

D. Motor-Controller Fuses: Install indicated fuses in each fusible switch.

3.3 CONTROL WIRING INSTALLATION

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for cable trays specified in Section "Cable Trays for Electrical Systems."
2. Comply with requirements for raceways and boxes specified in Section "Raceways and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Connect hand-off-automatic switch and other automatic control devices where available.

1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, fire-related cutouts and motor overload protectors.

3.4 IDENTIFICATION

A. Identify motor-control components and control wiring according to other Division 23 Sections.

3.5 STARTUP SERVICE

A. Testing: After installing motor controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.
2. Remove and replace malfunctioning units with new units, and retest.

B. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

C. Harmonic filtering. The VFD supplier shall, with the aid of the buyer’s detailed electrical power single line diagram showing all impedances in the power path to the VFDs, perform an analysis to initially demonstrate the supplied equipment will met the IEEE recommendations after installation. If, as a result of the analysis, it is determined that additional filter equipment is

required to meet the IEEE recommendations, then the cost of such equipment shall be included in the drive supplier quotation.

3.6 ADJUSTING

A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 CLEANING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 0512

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0513

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inchannular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in other Sections.

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete and Masonry Walls above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

2. Interior Concrete or Masonry Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 23 0517

SECTION 23 0518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service and Equipment room Spaces: One-piece, cast-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 23 0518

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections:

1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section "Vibration Controls for HVAC" for vibration isolation devices.
3. Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC 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, including pipe stands, 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.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 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.

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 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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. Flex-Strut Inc.
d. Thomas & Betts Corporation, A Member of the ABB Group.
e. Unistrut; an Atkore International company.
f. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: galvanized or alternate rust preventing shop coating.
8. Paint Coating: two coats primer and one coat enamel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International.
b. Empire Industries, Inc.
c. ERICO International Corporation.
d. Haydon Corporation.
e. NIBCO INC.
f. PHD Manufacturing, Inc.
g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: galvanized or alternate rust preventing shop coating.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields Inc.
7. Piping Technology & Products, Inc.

8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. 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.

C. Insulation-Insert Material for Hot 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.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches minimum or 2 ½ times the pipe diameter beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 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.

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. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary 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.

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 attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. 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. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. 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.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. 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.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. 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.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. 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.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system 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.

END OF SECTION 23 0529

SECTION 23 0548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Open-spring isolators.
3. Spring hangers.
4. Roof Curbs

B. Related Requirements:

1. Section "Vibration Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ace Mountings Co., Inc.
    b. Kinetics Noise Control, Inc.
    c. Mason Industries, Inc.
    d. Vibration Eliminator Co., Inc.
    e. Vibration Isolation.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth pattern.

2.2 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ace Mountings Co., Inc.
    b. Kinetics Noise Control, Inc.
    c. Mason Industries, Inc.
    d. Vibration Eliminator Co., Inc.
    e. Vibration Isolation.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.3 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ace Mountings Co., Inc.
   b. Kinetics Noise Control, Inc.
   c. Mason Industries, Inc.
   d. Vibration Eliminator Co., Inc.
   e. Vibration Isolation.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section "Cast-in-Place Concrete." And Section "Miscellaneous Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

3.3 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section "Cast-in-Place Concrete." And Section "Miscellaneous Cast-in-Place Concrete."

3.4 VIBRATION ISOLATOR SCHEDULE

A. Supported Equipment: Condensing Units

1. Equipment Location: Grade.
2. Isolator Type: Elastomeric Isolation Pads.
3. Base Type: None.
4. Minimum Deflection: 0.25”

B. Supported or Suspended Equipment: Energy Recovery Units and Air Handling Units

1. Equipment Location: Suspended.
2. Isolator Type: Open Spring Isolators.
3. Base Type: Curb.
4. Minimum Deflection: 1.0”

C. Suspended Equipment: Inline Fans

1. Spring Hangers – refer to section “Power Ventilators”

END OF SECTION 23 0548.13

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.

1.3 ACTION SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content.
6. Minimum Letter Size: 1/4 inch

7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

2. Testing, Adjusting, and Balancing Equipment:

a. Motors.
b. Condensing units.
c. Heat-transfer coils.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An entity engaged to perform TAB Work.

G. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article in Part 3.

D. Sample report forms.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

F. Certified TAB reports: as specified in “Final Report” Article in Part 3.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC .
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms certified by the test and balance agent.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contract Document Review:

1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. Notify Architect of any such conditions.
2. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible. Notify Architect if any devices are found to be in inaccessible locations.
3. Examine the approved submittals for HVAC systems and equipment. Notify Architect of any discrepancies found between design contract documents and approved submittals.

B. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

C. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section "Metal Ducts" and/ or Section "Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

D. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment

performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

F. Examine test reports specified in individual system and equipment Sections.

G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

H. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. General:

   a. Permanent electrical-power wiring is complete.
   b. Automatic temperature-control systems are operational.
   c. Equipment and duct access doors are securely closed.
   d. Windows and doors can be closed so indicated conditions for system operations can be met.

2. Airside:

   a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
   b. Duct systems are complete with terminals installed.
   c. Volume, smoke, and fire dampers are open and functional.
   d. Clean filters are installed.
   e. Fans are operating, free of vibration, and rotating in correct direction.
   f. Variable-frequency controllers' startup is complete and safeties are verified.
   g. Automatic temperature-control systems are operational.
   h. Ceilings are installed.
   i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section "Duct Insulation," Section "HVAC Equipment Insulation," and Section "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.9 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.10 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 0593

SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply, return, and outdoor air.
2. Indoor, exposed in mechanical room supply, return, and outdoor air.
3. Indoor, concealed relief ductwork between air inlet devices and energy recovery units.

B. Related Sections:

1. Section "HVAC Piping Insulation."
2. Section "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

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.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum 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. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. 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.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. 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.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction and UL Listed for rating on grease duct applications.

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. 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."

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. 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).

2. 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. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
3. Service Temperature Range: 0 to plus 180 deg F.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. 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).
6. 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. PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. 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).
6. 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."

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.9 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. Adhesive: As recommended by jacket material manufacturer.
2. Color: White

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

2.10 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inchdiameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    b. Spindle: Copper- or zinc-coated, low-carbon steel, Aluminum, Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. 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. Comply with the following requirements:

    a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
    b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
    c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel, aluminum, 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. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

2.11 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. 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.

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. 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 duct flanges and fittings.

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.

3.4 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 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.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves per the UL listing of the damper.

1. Comply with requirements in other Sections specifying firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

F. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeves per the UL listing of the damper.

1. Seal penetrations through fire-rated assemblies. Comply with requirements in other Sections specifying penetration firestopping materials.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces, or as recommended in manufacturer’s printed instructions.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions, or as recommended in manufacturer’s printed instructions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not over compress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not over compress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

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 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.

3.7 FINISHES

A. Insulation with Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section "Exterior Painting" and Section "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. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, 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 for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed: supply, return, and outdoor air, including lined duct.
2. Indoor, exposed in mechanical rooms: supply, return, and outdoor air, including lined duct.
3. Above ceiling surfaces of all air devices.
4. Relief ductwork between air inlet devices and energy recovery units.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Transfer ducts.
7. Exhaust duct serving toilets, janitor’s closets, and electrical rooms.

8. Exposed in occupied spaces: double wall spiral duct.
9. Exposed in occupied spaces: lined duct.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. All indoor insulation shall have a minimum R-value = 6.0.

B. Concealed, round and flat-oval, supply-air duct, outdoor air duct and return air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.

C. Concealed, rectangular, supply-air duct, outdoor air duct and return air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
   1 ½thick and 0.75-lb/cu. ft. nominal density may be used for lined duct.
2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.

D. Concealed, supply-air plenum, return air plenum, and outdoor air plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density. 1 ½thick and 0.75-lb/cu. ft. nominal density may be used for lined duct.
2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.

E. Concealed, relief ductwork between air inlet devices and energy recovery units shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density. 1 ½thick and 0.75-lb/cu. ft. nominal density may be used for lined duct.
2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.

F. Exposed in mechanical rooms, round and flat-oval, supply-air duct, return air duct, and outdoor air duct and insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density. 1 ½thick and 0.75-lb/cu. ft. nominal density may be used for lined duct.
2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.

G. Exposed in mechanical rooms, rectangular, supply-air duct, return air duct, and outdoor air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

H. Exposed in mechanical rooms, supply-air plenum, return air plenum, and outdoor air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. density.

I. Exposed in mechanical rooms, relief ductwork between air inlet devices and energy recovery units shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

3.11 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. Ducts and Plenums, Concealed:

1. None.

C. Ducts and Plenums, Exposed in mechanical rooms:

1. Finish ductwork insulation exposed in each mechanical room with a field applied 8 ounce per square yard canvas jacket cemented in place with white lagging adhesive.
2. Apply PVC pipe fitting covers over canvas.
3. Paint canvas with two coats of enamel paint. Colors shall be approved by the Architect.

END OF SECTION 23 0713

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors.
2. Refrigerant suction and hot-gas piping, indoors and outdoors.
3. Refrigerant piping used in VRF systems.

B. Related Sections:

1. Section "Duct Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

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 and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 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. 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, provide one of the following

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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 Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. 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).
2. 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. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.

2.6 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.
7. Flexible Connectors

3.4 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 "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 "Penetration Firestopping."

3.5 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.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers 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 manufacturers 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 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 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. Condensate Drainage piping located in crawl spaces or outdoors.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 3/8 inch thick.

B. Refrigerant Suction and Hot-Gas Piping and Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 3/4 inch thick.

C. Refrigerant Piping used in variable refrigerant flow systems:

1. Pipe sizes 1” and below: Insulation shall be the following:

a. Flexible Elastomeric: ¾ inch thick.

2. Pipe sizes above 1”: Insulation shall be the following:

a. Flexible Elastomeric: 3/4 inch thick.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping and Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

B. Refrigerant Piping used in variable refrigerant flow systems:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.11 OUTDOOR, 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. Piping, Outdoor:

1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 23 0719

SECTION 23 0900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

1. Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, coils, dampers, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Schedule of dampers including size, leakage, and flow characteristics.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.

2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

B. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: control system manufacturer's authorized representative who is trained and approved for installation of system components 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. Manufacturer Qualifications: Engage a firm experienced in manufacturing control systems similar to those indicated for this Project and that have a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 26 sections relating to Fire-Alarm Systems to achieve compatibility with equipment that interfaces with that system.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

B. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. UL recognized DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

C. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

D. Relays:

1. Control relays shall be UL listed plug-in type with dust cover. Contract rating, configuration and coil voltage suitable for application.
2. Time delay relays shall be UL listed solid state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

2.2 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Exposed.
2. Set-Point Indication: Exposed.

C. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.

2.3 THERMOSTATS

A. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches "FAN ON-OFF".
2. Mount on single electric switch box.

B. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

C. Programmable Thermostats:

1. HVAC unit thermostats shall be manufacturer's standard electronic 7-day programmable model having an Off-Em-Ht.-Heat-Auto-Cool System switch and an Auto-On Fan switch. Provide multi-stage heating and cooling thermostat where controlled unit has multi-stage capability. Outdoor thermostat shall prevent strip heat from being energized above 45 degrees F. (Emergency heat position not required for non-heat pump unit.)

2. System switching positions shall control thermostat operation as follows:
   a. OFF - heating and cooling systems are off. If the fan switch is at the AUTO position, the cooling fan is also off.
   b. HEAT - heating system is controlled by the thermostat. Cooling system is off.
   c. AUTO - thermostat automatically switches between heat and cool modes, depending upon the indoor temperature.
   d. COOL - thermostat controls the cooling system. Heating system if off.
   e. EM.HT (Heat Pump Units Only) - emergency heat relay is energized on call for heat. Cooling system is off. Compressor is de-energized.

3. Fan switching positions shall control fan operation as follows:
   a. ON - fan operates continuously.
   b. AUTO - fan operates as controlled by the thermostat in heat pump systems for conventional cooling mode; fan shall operate as controlled by plenum switch in conventional heating mode.

4. Thermostat shall be furnished with the following features:
   a. Override function.
   b. Set up for four separate temperatures per day.
   c. Battery replacement without program loss.
   d. Proportional plus integral control.
   e. Automatic changeover from cooling to heating.
   f. Keypad lockout.

5. Thermostat display features include the following:
   a. Time of day.
   b. Actual room temperature.
   c. Programmed temperature.
   d. Day of week.
   e. System mode indications include "heating," "off," "fan auto," and "fan on."

2.4 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Dampers: Size for running torque calculated as follows:

a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

2. Coupling: V-bolt and V-shaped, toothed cradle.
3. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
4. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
5. Power Requirements (Two-Position Spring Return): as required.
6. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
7. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
8. Temperature Rating: Minus 22 to plus 122 deg F.
9. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
10. Run Time: 12 seconds open, 5 seconds closed.

2.5 DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. United Enertech Corp.
5. Vent Products Company, Inc.

B. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.6 SMOKE DETECTORS

A. Smoke detectors shall be located in the duct upstream of each smoke or combination fire/smoke damper. Detectors shall also be located on the wall adjacent to each smoke or combination fire/smoke damper located in plenum smoke partition.

B. In systems of over 2,000 cfm capacity smoke detectors approved for duct installation shall be installed at a suitable location in:

1. The main supply duct downstream of the unit filter and supply fan.

C. Smoke detectors and duct housings shall be provided under Division 26. Detectors shall be compatible with existing fire alarm system and shall be approved by the Owner.

D. Detectors and duct housings used to activate smoke dampers and shut down air handlers shall be mounted under Division 23. Detectors shall be mounted in accordance with NFPA 72.

1. Sampling tubes shall extend full width of duct.
2. Provide access door at smoke detector.
3. Test/reset switches for smoke detectors are furnished and installed under Division 26.

2.7 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units. Where not indicated otherwise, obtain power for control units from the nearest un-switched receptacle circuit.

B. Verify that all field end devices and wiring are installed before proceeding with installation.

3.2 INSTALLATION

A. Install software in control units. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 54 inches above the finished floor unless noted otherwise. Install wall thermostats minimum 8" away from door or window frames. Coordinate location with switches and other devices provided under other Divisions.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

E. Install automatic dampers according to Section "Air Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Section "Identification for HVAC Piping and Equipment."

H. Install refrigerant instrument wells, valves, and other accessories according to Section "Refrigerant Piping."

I. Install duct volume-control dampers according to Section "Metal Ducts."

J. Install electronic and fiber-optic cables according to Division 26."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according Division 26.

B. Install building wire and cable according to Division 26.

C. Install signal and communication according to Sections in division 26.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Route all wiring in plenum rated cable secured to structure.
    a. Exception: All wiring associated with smoke detectors, smoke dampers, fire alarm shutdowns and similar systems shall be routed in conduit.

3. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
5. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
6. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test each point through its full operating range to verify that safety and operating control set points are as required.
4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
5. Test each system for compliance with sequence of operation.
6. Test software and hardware interlocks.

B. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Temperature:

    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.

5. Stroke and adjust control dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.

6. Stroke and adjust control dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
7. Provide diagnostic and test instruments for calibration and adjustment of system.
8. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

3.6 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section "Demonstration and Training."

B. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

C. Include a minimum of 4 hours dedicated instructor time on-site.

D. Schedule training with Owner with at least 7 days' notice.

END OF SECTION 23 0900

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

A. DDC: Direct digital control.

1.4 INFORMATIONAL SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Shop Drawings showing operating sequences of various equipment, devices, components, and materials included in the Text and defining the components' contribution to the system.

1.5 SMOKE DETECTORS AND SMOKE DAMPERS

A. In systems with air handling capacity above 2,000 CFM and up to and including 15,000 CFM and all units serving egress corridors, the smoke detector mounted in the unit or main supply ductwork shall, when sensing smoke, shut down the Air Handing Unit. The smoke detectors shall be connected to the fire alarm system. The actuation of smoke detector shall activate a visible and supervisory signal at a constantly attended location. Where an outdoor condensing unit or heat pump is used it shall shut down those components.

B. Smoke (or Combination) Damper/Smoke Detector: Upon sensing smoke at the detector, the damper shall close. When the damper is closed, the indicator light shall illuminate on the ceiling below the damper.

1.6 ENERGY CONSERVATION

A. Dead Band: Where used to control both heating and cooling, zone thermostats shall be capable of providing a temperature dead band of at least 5ºF in accordance with ASHRAE standard 90.1.

B. All HVAC systems/units shall be scheduled for operation by the VRF controls system or programmable thermostats. Coordinate the occupancy schedules with the Owner.

C. In unoccupied mode, the temperature set point shall be set back to 50ºF (adjustable) for heating 85ºF (adjustable) and 60% relative humidity (adjustable) for cooling. Units shall run only as required to maintain setback temperatures and humidity. Outside air dampers shall be closed during unoccupied mode where motorized dampers are indicated on the plans unless required for positive pressurization defined in other paragraphs of this section.

D. HVAC systems shall energize to cool or warm the spaces to normal occupied setpoint in morning warm up/ cool down mode. Outside air dampers shall NOT be open during warm-up/cool-down mode where motorized dampers are indicated on the plans.

E. Outside air systems shall only be energized when the building is in occupied mode.

F. Individual HVAC units shall be equipped with override features on unit thermostats. When the button is activated, the unit shall operate in occupied mode for a period determined by the Owner.

1.7 SAFETY SYSTEMS

A. All Air-handling units shall deenergize on any general building fire alarm activation.

B. An emergency air handling system shutdown switch shall be located adjacent to the main fire alarm panel. All air handling units shall de-energize whenever the master shutdown switch located at the main fire alarm panel is activated.

1.8 RELIABILITY AND GENERAL ALARM SYSTEMS

A. Auto Restart: All HVAC systems and equipment shall be configured such that normal operation is resumed after a power failure.

1.9 VARIABLE REFRIGERANT FLOW (VRF) SYSTEMS:

A. The sequence of operation for VRF systems shall be in accordance with the system manufacturer’s requirements, utilizing controllers furnished as part of the system.

B. In general, indoor heat pump units shall provide heat or cooling in response to their individual thermostat/controller.

C. The central system shall coordinate the operation of the outdoor and indoor units to provide for space temperature control, refrigerant flow control and compressor operation.

D. During the Occupied Mode, the VRF system will be enabled in the Auto Mode. The fan will run continuously, and the compressors will operate in a cooling or heating mode in response to the local room temperature interface.

E. Upon entering the Occupied Mode, the initial fan speed setting will be high (configurable) and will revert to local control should the fan speed be overridden by the local interface.

F. Upon entering the Occupied Mode, the setpoint will be overwritten with the occupied setpoint (configurable) and will revert to local control should the setpoint be adjusted from the local interface. Heating and Cooling Temperature Limits (configurable) will be available to prevent the local occupant from adjusting the heating and cooling setpoint too drastically.

G. Upon entering the Unoccupied Mode, the fan will be commanded to low speed (configurable).

H. During the Unoccupied Mode, the unit will remain off unless the space temperature exceeds the unoccupied heating and cooling setpoints. If the unit turns on to maintain Unoccupied setpoints it will remain on until it satisfies the Unoccupied setpoints by 2° (adjustable) before being turned off.

1.10 ELECTRIC HEATERS OPERATING SEQUENCE

A. Unit Heater, Electric: Room thermostat cycles fan and sequences stages of heating.

1. The unit heaters will control off of wall thermostats and not tie into the control system.

1.11 UNITARY SYSTEMS

A. Heat Pump Units:

1. Units shall be controlled by programmable thermostats.
2. Runtime of the unit shall be scheduled by the programmable thermostat.
3. When unit is scheduled to run, the compressor, heat/cool reversing valve and supply fan shall energize in heating or cooling mode as required to satisfy the thermostat setpoint.
4. When the compressor is unable to meet the heating requirements, the auxiliary strip heat shall energize.
5. When outdoor air temperature is above 45ºF (adj), resistance heat shall not be energized.

1.12 VENTILATION SEQUENCES

A. Exhaust Fan: See fan schedule on drawings.

1. Where fans are indicated to be interlocked with room lighting, furnish starters/contactors as required for control operation.
2. Exhaust Fan: Where exhaust fan serves more than a single space; provide a line voltage relay for each room and connect relays in parallel so that turning lights on in any room will start exhaust fan.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0993

SECTION 23 2113 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Condensate-drain piping.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed. Stored piping shall be elevated above grade. Stored piping shall not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from dirt, debris, and moisture.

D. Protect stored plastic piping from direct sunlight. Support to prevent sagging and bending.

1.5 COORDINATION

A. Coordinate layout and installation of piping with equipment and with other installations.

B. Coordinate pipe sleeve installation for foundation wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate installation of pipe sleeves for penetrations in exterior walls and floor assemblies.

F. Coordinate with requirements for firestopping for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Condensate drain piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Condensate-Drain Piping: 150 deg F.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L .

B. Copper or Bronze Pressure-Seal Fittings:

1. Housing: Copper.
2. O-Rings and Pipe Stops: EPDM.
3. Tools: Manufacturer's special tools.
4. Minimum 200-psig working-pressure rating at 250 deg F.

C. Wrought-Copper Unions: ASME B16.22.

2.3 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:

1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.5 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. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Condensate-Drain Piping: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations are approved by the engineer.

B. Install piping tight to slabs, beams, joists, columns, walls, and other building elements unless noted otherwise.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation plus 1-inch clearance around insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install unions in piping, NPS 2and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install shutoff valve immediately upstream of each dielectric fitting.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

3.3 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 unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Comply with requirements in Section "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE 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 pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. 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 unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

3.7 CLEANING

A. Before installation of copper tubing, clean tubing and fittings with trichloroethylene.

END OF SECTION 23 2113

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Hot-gas bypass valves.
4. Filter dryers.
5. Strainers.
6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed. Stored piping shall be elevated above grade. Stored piping shall not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from dirt, debris, and moisture.

1.9 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and [**24**] [**115**] [**208**]-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

B. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

C. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Working Pressure Rating: 500 psig.

8. Maximum Operating Temperature: 240 deg F.

D. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Hot-Gas and Liquid Lines: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

B. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 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 by the engineer.

B. Verify final equipment locations before roughing in piping.

C. Install piping tight to slabs, beams, joists, columns, walls, and other building elements unless noted otherwise.

D. Install refrigerant piping according to ASHRAE 15.

E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

F. 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.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

H. Install piping adjacent to machines to allow service and maintenance.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Refer to Section "Instrumentation and Control for HVAC" and Section ”Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

M. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

N. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or

panels as specified in Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

O. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

P. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

Q. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Identify refrigerant piping and valves according to Section "Identification for HVAC Piping and Equipment."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 2300

SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.

B. Related Sections:

1. Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this section, the following definitions apply:

B. Longitudinal Seams: Joints oriented in the direction of airflow.

C. Transverse joints: Connections of the two duct sections oriented perpendicular to airflow.

D. Duct wall penetrations: Openings made by any screw, fastener, pipe, rod or wire.

E. SMACNA Seal Classes are defined as follows:

1. A - All transverse joints, longitudinal seams, and duct wall penetrations.
2. B – All transverse joints and longitudinal seams.
3. C – Transverse joints only.

F. Conditioned Spaces: a cooled space, heated space, or indirectly conditioned space. An indirectly conditioned space includes return air plenums.

1.4 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. NFPA 90A, “Standard for the Installation of Air Conditioning and Ventilation Systems”

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle sealant materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

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. McGill AirFlow LLC.
2. Sheet Metal Connectors, Inc.

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse 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."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," 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."

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

G. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

H. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse 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."

I. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse 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."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse 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."

a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," 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."

a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

2.5 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 or G90 for use in concealed, interior ductwork, G90 for all exterior and exposed ductwork.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.6 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

2. Solvent or Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. 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. Surface shall be smooth and coated to prevent erosion of glass fibers into air stream.
4. Sound Absorption Coefficient NRC shall be no less than 0.70 for 1” thick.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Water resistant.
4. Mold and mildew resistant.
5. VOC: Maximum 75 g/L (less water).
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor or outdoor.
8. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Water resistant.
6. Mold and mildew resistant.
7. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. VOC: Maximum 395 g/L.
9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
10. Service: Indoor or outdoor.
11. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article below, and according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Solvent based sealant shall only be used in applications where freezing may occur before sealant is cured. Water based sealant shall be used in all other applications.

C. Prepare duct surface in accordance with duct sealant manufacturer’s printed instructions.

D. Seal externally insulated ducts prior to installation of insulation.

E. All duct sealing shall be in accordance with ASHRAE standard 90.1.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section "Exterior Painting" and Section "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Inspections and Leakage Tests:

1. All ductwork shall be approved by Architect prior to the application of external insulation. Smoke testing, pressure testing, or other leakage testing will be required if inspection is not performed.

3.8 CLEANING

A. Vacuum ducts prior to final acceptance to remove construction dust and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A for ducts located outdoors, B for ducts located in unconditioned spaces, and C for ducts located in conditioned spaces.
c. Round runouts to supply diffusers may be “snap-lock” duct meeting the pressure classification.

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 4-inch wg.
b. Minimum SMACNA Seal Class: A for ducts located outdoors and in unconditioned spaces, B for ducts located in conditioned spaces.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Exposed round duct shall be medium pressure spiral duct with mill-phosphatized (paint grip) treatment. Prime and paint color as directed by architect.

C. Return Ducts:

1. All Return Ducts:

a. Pressure Class: negative 2-inch wg.
b. Minimum SMACNA Seal Class: A for ducts located outdoors, B for ducts located in unconditioned spaces and C for ducts located in conditioned spaces.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: C for ducts located outdoors and in unconditioned spaces, and B for ducts located in conditioned spaces.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: C for ducts located outdoors and in unconditioned spaces, and B for ducts located in conditioned spaces.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.
b. Minimum SMACNA Seal Class: C.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless-Steel Ducts: Match duct material.
3. Aluminum Ducts: Aluminum.

G. Liner:

1. Supply, Return, and Exhaust Air Ducts: Fibrous glass, 1 inch thick.
2. Supply Fan Plenums: Fibrous glass, 1 inch thick.
3. Return- and Exhaust-Fan Plenums: Fibrous glass, 2 inches thick.
4. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

H. Double-Wall Duct Interstitial Insulation:

1. Supply, return and exhaust Air Ducts: 1 inch thick.

I. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

J. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Adjustable takeoff fitting.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 3113

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Control Dampers.
3. Fire dampers.
4. Ceiling radiation dampers
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Flange connectors.
8. Turning vanes.
9. Duct-mounted access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.

B. Related Requirements:

1. Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Section "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
3. Section "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.

c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 3 finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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. American Warming and Ventilating.
    b. Flexmaster U.S.A., Inc.
    c. McGill AirFlow LLC.
    d. Metalaire
    e. Nailor Industries Inc.
    f. Pottorff.
    g. Ruskin Company.
    h. Vent Products Co., Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

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. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Metalaire
6. Nailor Industries Inc.
7. NCA Manufacturing, Inc.
8. Pottorff.
9. Prefco; Perfect Air Control, Inc.
10. Ruskin Company.
11. Vent Products Company, Inc.
12. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity. Dampers used on medium pressure (VAV systems) shall be rated for 3000 fpm and 8”wg static pressure.

D. Fire Rating: 1-1/2 or 3 hours as indicated by the wall ratings on the architectural plans

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.05 or 0.138 inch] thick, as indicated, and of length to suit application.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch-0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.5 CEILING RADIATION DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Metalaire
4. Nailor Industries Inc.
5. Pottorff.
6. Prefco; Perfect Air Control, Inc.
7. Ruskin Company.
8. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Fire Rating: 1-1/2 or 3 hours as indicated by the wall ratings on the architectural plans.

2.6 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Metalaire

5. Nailor Industries Inc.
6. Pottorff.
7. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Smoke detectors and duct housings shall be provided under Division 26. Detectors shall be compatible with existing fire alarm system and shall be approved by the Owner.

D. Frame: Hat-shaped, 16 gage, galvanized sheet steel, with 13 gage channel frame.

E. Blades: Roll-formed, horizontal, 14 gage, galvanized sheet steel.

F. Leakage: Class I.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.05-inch-thick, galvanized sheet steel; length to suit wall or floor application.

I. Damper Motors: two-position action. Actuator with end switch. All actuators shall be factory mounted outside of the airstream. Furnish damper end switch for control interlocks.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC 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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section "Instrumentation and Control for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:

1. Auxiliary switches for damper position, remote indication.
2. Damper test switch.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Single piece, hat-shaped, 16 gage, galvanized sheet steel, with 13 gage channel frame.

F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

G. Smoke Detector: Smoke detectors and duct housings shall be provided under Division 26. Detectors shall be compatible with existing fire alarm system and shall be approved by the Owner.

H. Blades: Roll-formed, horizontal, 14 gage, galvanized sheet steel.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.039-inch-thick, galvanized sheet steel; length to suit wall or floor application.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: two-position action. Actuator with end switch. All actuators shall be factory mounted outside of the airstream. Furnish damper end switch for control interlocks.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC 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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section "Instrumentation and Control for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or

adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

O. Accessories:

1. Auxiliary switches for for damper position, remote indication.
2. Damper test switch.

2.8 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.9 TURNING VANES

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.10 DUCT-MOUNTED ACCESS DOORS

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. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen Manufacturing.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. McGill AirFlow LLC.
8. Nailor Industries Inc.
9. Pottorff.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel where indicated.
d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

2.11 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.

3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.12 FLEXIBLE CONNECTORS

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.13 FLEXIBLE DUCTS

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. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
4. ATCO.

B. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: 6.0.

C. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.14 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream or downstream from duct silencers.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Label access doors according to Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect diffusers to ducts with maximum 48-inch lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with draw bands.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 3300

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Ceiling-mounted ventilators.
   2. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

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. Wiring Diagrams: For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.8 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme
2. Barry Blower
3. Breidert Air Products.
4. Broan-NuTone LLC.
5. Carnes Company.
6. Cincinnati Fan & Ventilator Co.
7. Greenheck Fan Corporation.
8. Loren Cook Company.
9. PennBarry.
10. Twin City

B. Housing: Steel, lined with acoustical insulation. Furnish inline configuration where indicated on the drawings.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. Barry Blower.
3. Breidert Air Products.
4. Carnes Company.
5. Cincinnati Fan & Ventilator Co.
6. Greenheck Fan Corporation.
7. Hartzell Fan Incorporated.
8. Loren Cook Company.
9. PennBarry.
10. Twin City.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
6. Vibration Isolators:

    a. Type: Hanging spring isolator.
    b. Static Deflection: 1 inch.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC 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.

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:

1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section "Cast-in-Place Concrete." and/or Section "Miscellaneous Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section "Vibration and Seismic Controls for HVAC."
3. Comply with requirements for vibration isolation devices specified in Section "Vibration Controls for HVAC."

C. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section "Roof Accessories" for installation of roof curbs.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch deflection.

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

B. Review data in the operation and maintenance manuals.

END OF SECTION 23 3423

SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ceiling and wall mounted diffusers, registers, grilles and exterior louvers.

B. Related Sections:

1. Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS, REGISTERS AND GRILLES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anemostat Products; a Mestek company.
b. Carnes.
c. Hart & Cooley Inc.
d. Krueger
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Price Industries.
h. Titus.
i. Tuttle & Bailey.
j. United Enertech

2.2 EXTERIOR LOUVERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Arrow
    b. Greenheck
    c. Vent Products
    d. Ruskin

2. Depth: 6 inches.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. After installation of diffusers, registers, grilles and louvers, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 3713

SECTION 23 3723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof hoods.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which roof curbs and ventilators will be attached.
2. Sizes and locations of roof openings.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.

E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

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

2.2 FABRICATION, GENERAL

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corporation.
2. Aerovent.
3. Carnes.
4. Greenheck Fan Corporation.
5. JencoFan.
6. Loren Cook Company.
7. PennBarry.
8. Twin City Fans

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Materials: Heavy Gage Aluminum construction suitably reinforced and corrosion resistant.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 12 inches above roof surface.

E. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work. Secure ventilator to roof curb with cadmium plated screws, minimum two per side.

B. Install gravity ventilators with clearances for service and maintenance.

C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section "Joint Sealants" for sealants applied during installation.

E. Label gravity ventilators according to requirements specified in Section "Identification for HVAC Piping and Equipment."

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Section "Metal Ducts" and Section "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 23 3723

SECTION 23 8126 - SPLIT-SYSTEM HEAT PUMPS AND AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

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. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning and heat pump units to include in emergency, operation, and maintenance manuals.

B. Manufacturer’s startup worksheets for each unit on project.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Three set(s) for each air-handling unit.
2. Fan Belts: One set(s) for each air-handling unit fan.

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. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

D. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendations.

B. The unit controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin
2. Carrier Corporation.
3. Friedrich Air Conditioning Company.
4. Lennox International Inc.
5. LG Electronics, HVAC Division
6. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
7. McQuay International.
8. SANYO North America Corporation; SANYO Fisher Company.
9. Trane; a brand of Ingersoll Rand.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with baked enamel finish and flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110. Furnished with expansion device, check valve and defrost thermostat accessory.
4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection. Heater shall be designed specifically for the indoor unit and shall meet all requirements of the National Electric Code and Underwriters Laboratories and shall be so stamped.
5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
6. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed (minimum 3 speed) with internal thermal protection and permanent lubrication.
    c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
8. Filters: 1-inch thick minimum, disposable, framed with filter rack.
9. Condensate Drain Pans:

    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches deep.

    b. Single-wall, galvanized-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

B. Wall-Mounted, Ductless Components:

1. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit, in conjunction with the wired wall-mounted, wireless wall-mounted or wireless handheld controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry air before shipment from the factory.

2. The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white – Munsell 1.0Y 9.2/0.2. The unit shall be wall mounted by means of a factory supplied, pre-drilled, mounting plate.

3. The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: Low, Mid, and Hi and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

4. There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.

5. Return air shall be filtered by means of an easily removable washable filter.

6. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed

with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. An optional drain pan level switch (DPLS1), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing. A condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available.

7. The power to the indoor unit shall be supplied from the outdoor unit.

8. The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN152 and a 12 VDC output.

9. Remote Controllers

   a. Wired Remote Controller shall be approximately 5” x 5” in size and white in color with a light-green LCD display. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F), and Temperature changes shall be by increments of 1°F. The controller shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters).

   b. The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. Up to two wired controllers shall be able to be used to control one unit.

2.3 INDOOR UNITS (6 TONS OR MORE)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110. Furnish dual circuit where specified on drawings.
4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box

for overcurrent protection. Heater shall be designed specifically for the indoor unit and shall meet all requirements of the National Electric Code and Underwriters Laboratories and shall be so stamped.

5. Fan: Forward-curved, centrifugal type, double-width wheel of galvanized steel; directly connected to motor. Adjustable belt drive.
6. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section "Common Motor Requirements for HVAC Equipment."
    b. Adjustable motor sheaves with internal thermal protection and permanent lubrication.
    c. Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection.
    d. Wiring Terminations: Connect motor to chassis wiring with plug connection.

7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
8. Filters: 1 inch thick, in fiberboard frames with filter rack.
9. Condensate Drain Pans:

    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches deep.

    b. Single-wall, galvanized-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

2.4 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Heavy gauge galvanized steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant Charge: R-410A.

d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient: Permits cooling operation down to 0 deg F.
7. Mounting Base: Polyethylene.
8. Furnish the following accessories: condenser coil guard, 5 minute anti recycle timer, hard start kit for units with single phase power, defrost for indoor coil, and outdoor air thermostat to prevent resistant heat from energized above 45 deg F (adjustable).

2.5 OUTDOOR UNITS (6 TONS OR MORE)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Heavy gauge galvanized steel, with weather resistant, baked enamel finish, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

   a. Compressor Type: Scroll.
   b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch. Furnish two separate and independent refrigeration circuits where specified on the drawings.
   c. Refrigerant Charge: R-410A.
   d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 0 deg F.
7. Mounting Base: Polyethylene.
8. Furnish the following accessories: condenser coil guard, 5 minute anti recycle timer, defrost for indoor coil, and outdoor air thermostat to prevent resistant heat from energized above 45 deg F (adjustable).

2.6 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section "Instrumentation and Control for HVAC" and Section "Sequence and Operations for HVAC Controls."

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Drain Hose: For condensate.

2.7 OUTDOOR UNITS (FOR USE WITH DUCTLESS UNITS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Galvanized Steel, thermally applied fused acrylic or powder coat finish, with easily removable panels for access to all service parts. Microprocessor controls, weep holes for water drainage, mounting feet, and fan grill. Provide brass service valves, fittings, and gage ports on exterior of casing. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory. Easy access shall be afforded to all serviceable parts by means of removable panel sections.
2. Compressor: The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.
3. Coil: The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor controlled step motor. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1” thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.
4. Fan: shall be furnished with a single DC fan motor. The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.
5. Motor: Permanently lubricated bearings, with integral thermal-overload protection.
6. Low Ambient: Permits cooling operation down to 0deg F.
7. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

2.8 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section "Instrumentation and Control for HVAC" and Section "Sequence and Operations for HVAC Controls."

B. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install unit’s level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s).

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Piping Connections: Comply with piping requirements specified in other sections.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section "Air Duct Accessories."

D. Electrical: Comply with all applicable sections regarding electrical and grounding requirements.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Furnish startup worksheet with close out documents.

B. Perform the following commissioning for all units:

1. Level unit on support structure.
2. Inspect for visible damage to unit casing.
3. Inspect for visible damage to compressor, air-cooled condenser coil, and fans.
4. Verify that clearances have been provided for servicing.
5. Check that labels are clearly visible.
6. Verify that controls are connected and operable.
7. Remove shipping bolts, blocks, and tie-down straps.
8. Verify that filters are installed.
9. Adjust vibration isolators.
10. Check acoustic insulation.
11. Lubricate bearings on fan.
12. Check fan-wheel rotation for correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.
15. Perform starting of refrigeration in summer only.
16. Complete startup sheets and attach copy with Contractor's startup report.
17. Check and record performance of interlocks and protection devices; verify sequences.
18. Operate unit for an initial period as recommended or required by manufacturer.
19. Calibrate thermostats.
20. Check internal isolators.
21. Check controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.
22. Simulate maximum cooling demand and check the following:
23. Compressor refrigerant suction and hot-gas pressures.
24. Short circuiting air through condenser or from condenser to outside-air intake.
25. After starting and performance testing, install clean filters, vacuum heat exchanger and cooling and condenser coils, lubricate bearings and adjust belt tension.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

2. Review data in the maintenance manuals.

3. Schedule training with Owner, through Architect, with at least 7 days' advance

END OF SECTION 23 8126

SECTION 23 8130 - VARIABLE REFRIGERANT SYSTEMS EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes variable refrigerant flow (VRF) systems and equipment. Systems are capable of providing simultaneous heating and cooling in adjacent zones on a single system (heat recovery type.)

B. Related Requirements:

1. Division Section "HVAC instrumentation and controls" for temperature control devices and control wiring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions and required clearances of individual components and profiles.
2. Include rated capacities, operating characteristics, electrical characteristics, weights, and furnished specialties and accessories. Clearly indicate exact models to be furnished.
3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
4. Refrigerant piping schematics showing sizes and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For variable refrigerant flow systems to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 INSTALLER QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer. Installer shall have successfully completed the manufacturer's service and installation course.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver indoor and outdoor units as factory-assembled units with protective crating and covering.

B. Coordinate delivery of units in sufficient time to allow movement into building.

C. Unit shall be stored and handled according to the manufacturer's recommendation.

D. Handle units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

1.7 QUALITY ASSURANCE

A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer and Installer agree to repair or replace components of variable refrigerant flow systems that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: five year(s) from date of Substantial Completion.
2. In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation.

B. System shall be installed by Manufacturer's factory certified and trained dealer.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Filters: One extra set of washable filters for half the total number of units provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Variable Refrigerant Flow Systems:

a. Carrier
b. Daiken AC
c. Mitsubishi

2. Two or Three pipe systems are acceptable.

2.2 HEAT RECOVERY TYPE OUTDOOR UNIT

A. General: The outdoor unit shall be designed and configured for use specifically with other VRF components included in the system. The outdoor units shall be equipped with multiple circuit boards that interface to the central VRF controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

1. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.
2. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
3. All refrigerant lines from the outdoor unit to the branch Circuit Controller and to individual units shall be insulated.
4. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
5. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
6. The outdoor unit shall have the ability to operate with a maximum height difference and total pipe length as shown on the drawings.
7. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional

low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

8. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
9. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized hail guard. The hail guard protects the outdoor coil surfaces from hail damage.
10. Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend "no or reduced heating" periods shall not be allowed.

B. Unit Cabinet: The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models.

C. Fan:

1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
3. All fan motors shall be mounted for quiet operation.
4. All fans shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant - R410A refrigerant shall be required for outdoor unit systems.

E. Coil:

1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor:

1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
2. A crankcase heater(s) shall be factory mounted on the compressor(s).
3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.
4. The compressor will be equipped with an internal thermal overload.
5. The compressor shall be mounted to avoid the transmission of vibration.

6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

G. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz. or 460 volts, 3-phase, 60 hertz.
2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz) or 414-506V (460V/60Hz).
3. Unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, Controllers and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.3 BRANCH CIRCUIT CONTROLLERS

A. General: The BC (Branch Circuit) Controllers shall be designed for use with the other VRF system components. These units shall be equipped with a circuit board that interfaces to the VRF controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

B. BC Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant: R410A refrigerant shall be required.

D. Refrigerant valves:

1. The unit shall be configured to support branching arrangements and capacities indicated on the drawings.
2. Each branch shall have multiple two-position valves to control refrigerant flow.
3. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without interruption to overall system operation.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan: An integral insulated condensate pan and drain shall be provided.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz and shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253V (230V/60Hz).
2. The branch Controller shall be controlled by integral microprocessors.

3. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.4 WALL MOUNTED INDOOR UNIT

A. General:

1. The wall-mounted indoor unit section and shall have a modulating linear expansion device and a flat front. The unit shall support individual control.

B. Indoor Unit

1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:

1. All casings, regardless of model size, shall have the same white finish
2. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
3. There shall be a separate back plate which secures the unit firmly to the wall.

D. Fan:

1. The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
4. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

E. Filter:

1. Return air shall be filtered by means of an easily removable, washable filter.

F. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.

6. Both refrigerant lines to the indoor units shall be insulated.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)

H. Controls:

1. This unit shall use controls provided by manufacturer to perform functions necessary to operate the system.
2. The unit shall be able to control external backup heat.
3. The unit shall have a factory built in receiver for wireless remote control.
4. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
5. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
6. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
7. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
8. Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
9. The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

2.5 4-WAY CEILING RECESSED CASSETTE WITH GRILLE

A. General

1. The indoor unit shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:

1. The cabinet shall be space-saving ceiling-recessed cassette.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

3. Branch ducting shall be allowed from cabinet.
4. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
5. The grille vane angles shall be individually adjustable from the wired remote controller to customize the airflow pattern for the conditioned space

C. Fan:

1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of five (5) speed settings, Low, Mid1, Mid2, High and Auto.
4. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
5. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
6. The indoor unit shall have switches that can be set to provide optimum airflow based on ceiling height and number of outlets used.
7. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.
8. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space.
9. If specified, the grille shall have an optional i-see sensor that will measure room temperature variations and adjust the airflow accordingly to evenly condition the space.

D. Filter: return air shall be filtered by means of a long-life washable filter

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.
7. Both refrigerant lines to the indoor units shall be insulated.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

2.6 COMPACT 4 WAY CEILING RECESSED CASSETTE WITH GRILLE

A. General:

1. The indoor unit shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested.

Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:

1. The cabinet shall be a compact 22-7/16" wide x 22-7/16" deep so it will fit within a standard 24" square suspended ceiling grid.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

C. Fan:

1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
4. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
5. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

D. Filter: Return air shall be filtered by means of a long-life washable filter.

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4" inches above the condensate pan.
7. Both refrigerant lines to the indoor units shall be insulated.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

2.7 CEILING CONCEALED DUCTED INDOOR UNIT

A. General

1. The ceiling-concealed ducted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic

modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. Unit Cabinet:

1. The unit shall be ceiling-concealed, ducted—with a 2-position, field adjustable return and a fixed horizontal discharge supply.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

C. Fan:

1. Indoor unit shall feature multiple external static pressure settings ranging from 0.14 to 0.60 in. WG.
2. The indoor unit fan shall be an assembly with statically and dynamically balanced Sirocco fan(s) direct driven by a single motor with permanently lubricated bearings.
3. The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function.

D. Filter: Return air shall be filtered by means of a standard factory installed return air filter. Optional return filter box (rear or bottom placement) with high-efficiency filter as noted on equipment schedule.

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
2. The coils shall be pressure tested at the factory.
3. Coil shall be provided with a sloped drain pan. Units without sloped drain pans which must be installed cockeyed to ensure proper drainage are not allowed.
4. The unit shall be provided with an integral condensate lift mechanism able to raise drain water 27 inches above the condensate pan.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

G. Controls:

1. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
2. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

3. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
4. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.8 VERTICAL AIR HANDLER

A. General - Indoor, direct-expansion, vertical AHU fan coil. Unit shall be complete with coil, fan driven by DC motor, EXV (electronic expansion valve), piping connectors, electrical controls, microprocessor control system, and integral temperature sensing.

B. Unit Cabinet: The cabinet shall be constructed of zinc-coated steel. The unit shall be capable of being configured for either vertical or horizontal flow.

C. Fan: Fan shall be of the multi-blade type with its performance designed to match the coil performance. The fan shall be statically and dynamically balanced to ensure low noise and vibration and capable of up to 0.8 in. wg external static pressure. Fan shall be capable of providing constant CFM automatically adjusting for external static pressures up to 0.8".

D. Filter:

1. The contractor shall provide a field fabricated filter rack.

E. Coil:
1. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion, and fins shall be coated with blue-fin finish for enhanced wettability and corrosion resistance.
2. A drip pan shall be constructed under the coil, with a ¾ in NPT connection for condensate drain piping.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. The condensate shall be gravity drained from the fan coil.
6. Both refrigerant lines to the indoor units shall be insulated.

F. Motors: Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.

G. Electrical: The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

H. Controls: The units shall be connected into a controls network with the other indoor units and outdoor units via a two wire 18GA stranded shielded control wire and shall have controls quick connections as standard. The system shall be microprocessor-controlled to maintain precise room temperature and maximize efficiency.

1. The units shall be capable of performing all initial settings from the remote controller without the need for adjusting physical dip switches.
2. Unit shall come with IR receiver as standard.
3. The system shall include ACB (auxiliary control board) interface adjacent to the indoor unit control board. This ACB interface shall provide three dry contact outputs to indicate operation (on/off) status of fan, cooling mode, and heating mode. This interface shall

also provide a fourth dry contact output to trigger auxiliary heat. Auxiliary heat output shall be configurable via wired controller with settings for temperature differentials and time delay.

2.9 INDOOR REHEAT UNIT

A. General: Indoor, direct-expansion, reheat fan coil. Unit shall be complete with coil, fan driven by DC motor, EXV (electronic expansion valve), piping connectors, electrical controls, microprocessor control system, and integral temperature sensing.

B. Unit Cabinet: Cabinet shall be constructed of zinc-coated steel.

C. Fan: Fan shall be of the multi-blade type with its performance designed to match the coil performance. The fan shall be statically and dynamically balanced to ensure low noise and vibration and capable of up to 1.0 in. wg external static pressure.

D. Filter: The cabinet shall be supplied with filter track and filter.

E. Coil: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion, and fins shall be coated with blue-fin finish for enhanced wettability and corrosion resistance. A drip pan under the coil shall have a factory-installed drain connection for hose attachment to remove condensate (gravity drain).

F. Motors: Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.

G. Electrical: The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

H. Controls: The units shall be connected into a controls network with the other indoor units and outdoor units via a two wire 18GA stranded shielded control wire and shall have controls quick connections as standard. The system shall be microprocessor-controlled to maintain precise room temperature and maximize efficiency.

1. The units shall be capable of performing all initial settings from the remote controller without the need for adjusting physical dip switches.
2. Unit shall come with IR receiver as standard.
3. The system shall include ACB (auxiliary control board) interface adjacent to the indoor unit control board. This ACB interface shall provide three dry contact outputs to indicate operation (on/off) status of fan, cooling mode, and heating mode. This interface shall also provide a fourth dry contact output to trigger auxiliary heat. Auxiliary heat output shall be configurable via wired controller with settings for temperature differentials and time delay.

2.10 CONTROLS

A. General:

1. The controls network shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet®.

B. Electrical Characteristics

1. General: controls network shall operate at 24VDC. Controller power and communications shall be via a common non-polar communications bus.
2. Wiring: Control wiring shall be installed in a daisy chain configuration from indoor unit to remote controller to indoor unit, to the controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
3. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.
4. Control wiring for the remote controllers shall be from the remote controller to the first associated indoor unit (TB-15) then to the remaining associated indoor units (TB-15) in a daisy chain configuration.
5. The centralized controller shall be capable of being networked with other centralized controllers for centralized control.
6. Wiring type: Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output. Network wiring shall be CAT-5e with RJ-45 connection.

C. Controls Network

1. The Controls Network consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Controls Network shall support operation monitoring, scheduling, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.

D. Deluxe Remote Controller

1. The Deluxe Remote Controller (PAR-21MAAU) shall be capable of controlling up to 16 indoor units (defined as 1 group). The Deluxe Remote Controller shall be approximately 5” x 5” in size and white in color with a light-green LCD display. The Deluxe Remote Controller shall support a selection from multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information. The Deluxe supports temperature display selection of Fahrenheit or Celsius. The Deluxe Remote Controller shall control the following grouped operations: On/Off, Operation Mode (cool, heat, auto (R2/WR2-Series Simultaneous Heating and Cooling only), dry, and fan), temperature set point, fan speed setting, and airflow direction setting. The Deluxe Remote Controller shall support timer settings of on/off/temperature up to 8 times in a day in 1-minute increments. The Deluxe Remote Controller shall support an Auto Off timer. The Deluxe Remote Controller shall be able to limit the set temperature range from itself. The room temperature shall be sensed at either the Deluxe Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Deluxe Remote Controller shall display a four-digit error code in the event of system abnormality or error.

2. The Deluxe Remote Controller shall only be used in the same group with other Deluxe Remote Controllers, Wireless controllers, or Simple Remote Controllers, with up to two remote controllers per group.
3. The Deluxe Remote Controller shall require no addressing. The Deluxe Remote Controller shall connect using two-wire, stranded, non-polar control wire to the TB15 connection terminal on the indoor unit. The controller shall require cross-over wiring for grouping across indoor units.

E. Backlit Simple Remote Controller

1. The Backlit Simple Remote Controller (PAC-YT53CRAU) shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple Remote Controller shall be compact in size, approximately 3" x 5" and have limited user functionality. The Backlit Simple Controller supports temperature display selection of Fahrenheit or Celsius. The Backlit Simple Remote Controller shall allow the user to change on/off, mode (cool, heat, auto (R2/WR2-Series only), dry, and fan), temperature setting, and fan speed setting and airflow direction. The Backlit Simple Remote Controller shall be able to limit the set temperature range from the Backlit Simple controller. The Backlit Simple Remote controller shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the Backlit Simple Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Backlit Simple Remote Controller shall display a four-digit error code in the event of system abnormality/error.
2. The Backlit Simple Remote Controller shall only be used in same group with Deluxe Remote Controllers, Wireless Remote Controllers, or with other Backlit Simple Remote Controllers, with up to two remote controllers per group.
3. The Backlit Simple Remote Controller shall be capable of controlling the fan speed of an interlocked LOSSNAY to high/low/stop.
4. The Backlit Simple Remote Controller shall require no addressing. The Backlit Simple Remote Controller shall connect using two-wire, stranded, non-polar control wire to TB15 connection terminal on the indoor unit. The Simple Remote Controller shall require cross-over wiring for grouping across indoor units.

F. Centralized Controller (Web-enabled)

1. The Centralized Controller shall be capable of controlling a maximum of 200 indoor units across multiple vrf outdoor units. The Centralized Controller shall be approximately 11"x8" in size and shall be powered from an integrated Power Supply Unit. The Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. The Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the Centralized Controller shall include on/off, operation mode selection (cool, heat, auto, dry, and fan), temperature setting, fan speed setting, and airflow direction setting. Since the controller provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the Centralized Controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

2. All Centralized Controllers shall be equipped with one RJ-45 Ethernet port to support interconnection with a network PC via a closed/direct Local Area Network (LAN).
3. The Centralized Controller shall be capable of performing initial settings via the 9" high-resolution, backlit, color touch panel on the controller or via a PC using the Centralized Controller's initial setting browser.
4. Standard software functions shall be available so that the building manager can securely log into each controller via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Additional optional software functions of personal browser for PCs and MACs and Tenant Billing shall be available. The Tennant Billing function shall require TG-2000 Integrated System software in conjunction with Centralized Controllers.

G. Expansion Controller

1. The Expansion Controller shall serve as a standalone centralized controller or as an expansion module to the Centralized Controller for the purpose of adding up to 50 indoor units to either the main touch screen interface of the centralized controller. Up to three (3) expansion controllers can be connected to the centralized controller via a local IP network (and their IP addresses assigned on the centralized controller) to the centralized controller to allow for up to two hundred (200) indoor units to be monitored and controlled from the centralized controller interface.
2. The expansion controllers have all of the same capabilities to monitor and control their associated indoor units as the features specified above. Even when connected to expansion controller and configured to display their units on the main controller, the individual indoor units connected to the expansion controller can still be monitored and controlled from its interface. The last command entered will take precedence, whether at the wall controller, the expansion controller or the Centralized Controller.

H. Web-based User Interface (All PCs shall be field supplied)

1. PC-Monitoring (SW-Mon): The controls network shall be capable of monitoring and operating all indoor units from a networked PC's web browser for up to 50 units per AG-150/GB-50ADA and up to 24 units per GB-24 centralized controller.
2. PC Scheduling (SW-Sch): The controls network shall be capable of creating customized daily, weekly, and annual schedules from a network PC's web browser for up to 50 units per AG-150/GB-50ADA and up to 24 units per GB-24. Schedules shall be applied to a single indoor unit, a group of indoor units, or collectively (batch) to all indoor units controlled by the AG-150/GB-50ADA/GB-24.
3. Online Error Email (SW-Email): The controls network shall be capable of sending detailed alerts to customizable distribution lists based on user defined error types.
4. Online Maintenance Diagnostics (SW-Maint): The controls network shall be capable of performing maintenance diagnostics via a network PC and AG-150/GB-50ADA/GB-24 centralized controller using Maintenance Tool Software.
5. Interlock Function (SW-Interlock): Allows configuration and control of free inputs/outputs on the indoor units.
6. Personal Web Browser (SW-Pweb): The control network shall be capable of allowing up to 50 individual users to monitor and control user defined zones via a network PC or MAC's web browser.

I. Graphical User Workstation Software (field supplied PC.)

1. The Integrated System Software shall enable the user to control multiple controllers and shall provide additional functions such as tenant billing from a single, dedicated network PC configured with the software. The software shall be a configured computer shall be capable of controlling up to forty Centralized Controllers with a maximum of 2,000 indoor units across multiple outdoor units. The software shall be required if the user wants to simultaneously control more than 1 Centralized Controllers from a single PC using a single software session. Licensing per function, per Centralized Controller shall be required for the software. Optional software features shall be available through the software including tenant billing. These optional software features shall require the software, advance purchase from the customer, and licensing from Mitsubishi to enable feature activation.

J. Controls Network System Integration: the controls network shall be capable of supporting integration with Building Management Systems (BMS).

1. BACnet® Interface: The BACnet® interface, BAC-HD150, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support BACnet Broadcast Management (BBMD). The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.

K. Power Supply (PAC-SC51KUA)

1. The power supply shall supply 24VDC (TB 3) for the centralized controller and 24VDC (TB 2) voltage for the central control transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting installation and performance of the Work.

B. Examine roughing-in for piping to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, roofs, and for suitable conditions where VRF systems will be installed.

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

3.2 INSTALLATION

A. Comply with manufacturer’s instruction for installation of VRF systems.

B. Comply with requirements for pipe hangers and supports specified in Section Hangers and Supports for HVAC Piping and Equipment."

C. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays specified in Section "Cable Trays for Electrical Systems."
3. Comply with requirements for raceways and boxes specified in Section "Raceways and Boxes for Electrical Systems."

D. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
1. Install piping to allow service and maintenance.

B. Duct installation requirements are specified in other Sections. Drawings indicate the general arrangement of ducts. Furnish flexible connections at all unit connections.

C. Electrical: Conform to applicable requirements in specification Sections.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Section “Identification for HVAC Piping and Equipment.”

3.5 COMMISSIONING

A. Verify that installation is as indicated and specified. Furnish manufacturer’s system commissioning report with warranty number.

B. Complete installation and startup checks according to manufacturer's written instructions. At a minimum perform the following:

1. Level unit on support structure.
2. Inspect for visible damage to unit casing.
3. Inspect for visible damage to compressor, air-cooled condenser coil, and fans.
4. Verify that clearances have been provided for servicing.
5. Check that labels are clearly visible.
6. Verify that controls are connected and operable.
7. Remove shipping bolts, blocks, and tie-down straps.
8. Verify that filters are installed.
9. Adjust vibration isolators.
10. Check acoustic insulation.

C. Lubricate bearings on fan.

D. Check fan-wheel rotation for correct direction without vibration and binding.

E. Adjust fan belts to proper alignment and tension.

F. Start unit according to manufacturer's written instructions.

1. Perform starting of refrigeration in summer only.
2. Complete startup sheets and attach copy with Contractor's startup report.

G. Check and record performance of interlocks and protection devices; verify sequences.

H. Operate unit for an initial period as recommended or required by manufacturer.

I. Calibrate thermostats.

J. Check internal isolators.

K. Check controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.

L. Simulate maximum cooling demand and check the following:

1. Compressor refrigerant suction and hot-gas pressures.
2. Short circuiting air through condenser or from condenser to outside-air intake.

M. After starting and performance testing, change filters, vacuum heat exchanger and cooling and condenser coils, lubricate bearings and adjust belt tension.

3.6 DEMONSTRATION AND TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain units. Training shall include offsite training for up to 8 persons, including travel expenses, course tuition, and all tools required. Training shall be no less than 4 days and shall include the following:

B. A course to provides hands-on experience building systems using manufacturers design software. Participants shall learn the warranty process and the steps to register products once they have been installed. The concepts of integration and centralized control shall be discussed

as well as the proper steps for system start-up. Proper service and diagnosis procedures shall also be covered.

C. A course to provide participants with an in-depth examination of the service tools necessary to perform operational monitoring of VRF equipment. Participants shall learn the refrigerant patterns of systems and the acceptable Maintenance Tool values during operation. The electrical flow and voltage checkpoints shall be covered in addition to the recommended steps for replacing faulty components. Instruction shall also include hands-on troubleshooting and Maintenance Tool data analysis to resolve system errors.

END OF SECTION 23 8130

SECTION 23 8239.19 - WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of anchorages and attachments to structure and to supported equipment.
3. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berko.

2. Chromalox, Inc.
3. INDEECO.
4. Markel Products; TPI Corporation.
5. Marley Engineered Products.
6. QMark Electric Heating.
7. Raywall
8. Redd-i

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

A. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Cabinet Enclosure: Steel with finish to match cabinet.

E. Configuration: Ceiling semi-recessed with bottom inlet and outlet and trim kit.

F. Filter: Permanent “Washable” type.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated. Comply with requirements in Section ”Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Controls: Unit-mounted thermostat, thermal safety cutout, automatic fan delay, and silent relay to eliminate sound of contactors opening and closing,

B. Optional Controls: night set back relay to provide ability to set back heater from energy management system, and ON-OFF switch to allow heater to be de-energized when not in use.

C. Electrical Connection: Factory wire motors and controls for a single field connection**.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

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

3.2 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A and in accordance with manufacturer’s instructions.

B. Install wall and ceiling unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing: After installing unit heaters and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

B. Remove and replace malfunctioning units with new units and retest.

3.4 ADJUSTING

A. Before final acceptance of the heaters, perform the following:

1. Furnish clean filters.
2. Perform test and balance as specified in division 23 “Testing, Adjusting, and Balancing”

END OF SECTION 23 8239.19

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SECTION 26 0000 - GENERAL

1.01 CONTRACT DOCUMENTS:

A. All work of Section 26 shall comply with the requirements of:

1. General Conditions
2. Supplementary General Conditions
3. General Requirements
4. Specifications
5. Drawings
6. Modifications incorporated in the documents before their execution.

1.02 WORK INCLUDED

A. This Division of the specifications (260000) covers the complete interior and exterior electrical system for all work shown on the drawings as specified herein providing all material, labor and equipment required for the installation of the electrical systems complete and in operating condition.

B. Include in the electrical work all the necessary supervision and the issuing of all coordinating information to any other trades who are supplying work to accommodate the electrical installations.

1.03 DRAWINGS

A. The drawings for electrical work utilize symbols and schematic diagrams which have no dimensional significance. The work shall therefore, be installed to fulfill the diagrammatic intent expressed on the electrical drawings.

B. Review architectural drawings for door swings, cabinets, counters, moldings and built-in equipment, conditions indicated on architectural drawings shall govern. Prior to rough-in of receptacles and systems outlets, refer to architectural casework drawings for rough-in coordination.

C. Coordinate electrical work with the architectural details, floor plans, elevations, structural and mechanical drawings. Provide fittings, junction boxes and accessories to meet conditions.

D. Do not scale drawings. Dimensions for layout of equipment, or spaces shall be obtained from architectural, structural or mechanical drawings unless specifically indicated on the electrical drawings.

E. Discrepancies shown on different drawings, between drawings and specifications or between drawings and field conditions shall be promptly brought to the attention of the Architect.

F. Provide as used on the drawings and in the specifications shall mean, furnish, install, connect, adjust and test.

G. The drawings and specifications are complimentary and any work or material shown in one and omitted in the other, or described in the one and not shown in the other, or which may be implied by both or either, shall be furnished as though shown on both, in order to give a complete and first class installation.

1.04 SITE INVESTIGATION

A. Potential Contractors shall visit the project site prior to bid date to satisfy themselves as to the existing conditions and distances which may effect the cost of the project. Where work under this project requires extension, relocation, re-connecting or modifications to existing equipment or systems, the existing equipment or systems, shall be restored to their original condition, with the exception of the work under this contract, before the completion of this project.

1.05 SHOP DRAWINGS

A. Submit for approval by the Architect all materials and equipment to be incorporated in the electrical work.

B. Submit only shop drawings which comply with the contract documents. Shop drawings shall be checked and corrected by the Contractor before they are submitted to the Architect. Shop drawings that are not corrected by the Contractor shall be returned for correction without detailed notations by the Architect as to the necessary corrections.

C. Mark each individual submittal item to show specification section which pertains to the item.

D. Submit information as required under SUBMITTALS, for each of the individual electrical sections of the specifications.

E. Data submitted shall contain all information required to indicate compliance with equipment specified.

F. Submit field information drawings to explain fully all procedures involved in erecting, mounting and connecting all items of equipment which differ from that specified.

G. When Shop Drawings are reviewed, some errors may be detected but others may be overlooked. This does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Drawings and Specifications shall be followed and are not waived or superseded in any way by the Shop Drawing review.

1.06 RECORD DRAWINGS:

A. One complete set of electrical drawings shall be reserved for as-built drawings. Any approved deviation from the contract drawings shall be recorded on these drawings. Drawings shall be checked monthly for completeness.

B. Completed as-built drawings shall be presented to the Architect prior to final inspection.

1.07 MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Provide at the time of final inspection three sets of maintenance and operating instruction for:

1. Fuses
2. Floor Boxes
3. Wiring Devices
4. LED Light Fixtures
5. Disconnect Switches
6. Fire Alarm System

B. Furnish a qualified and accredited factory trained technician to train personnel designated by the Owner in the proper operation and maintenance of specialized equipment.

C. The issuing of operating instructions shall include the submission of the name, address, and telephone number of the manufacturer's representative and service company for each item of equipment so that service and spare parts can be readily obtained.

1.08 CODES AND PERMITS:

A. All electrical work shall meet or exceed the latest requirements of the following codes and/or other authorities exercising jurisdiction over the electrical construction work and the project.

1. The National Electrical Code (NFPA 70) - 2020 Edition
2. The National Electrical Safety Code (ANSI C-2)
3. The Life Safety Code (NFPA 101) - 2018 Edition
4. The International Building Code - 2018 Edition
5. Regulations of the local utility company with respect to metering and service entrance.
6. Municipal and State ordinances governing electrical work.

B. All required permits and inspection certificates shall be obtained, and made available at the completion of the work. Permits, inspections, and certification fees shall be paid for as a part of the electrical work.

1.09 DEVIATIONS:

A. No deviations from the plans and specifications shall be made without the full knowledge and consent of the Architect or his authorized representative.

B. Should the Contractor find at any time during progress of the work that, in his judgment, existing conditions make desirable a modification in requirements covering any particular item or items, he shall report such items promptly to the Architect for his decision and instruction.

1.10 COOPERATION:

A. This Contractor shall schedule his work and in every way possible cooperate with all other Contractors on the job to avoid delays, interferences, and unnecessary work. He shall notify them of all openings, hangers, excavations, etc., so that proper provisions shall be made for his work. This shall not relieve him of the cost of cutting, when such is required.

B. This Contractor shall do all cutting and excavating necessary for the complete installation of his work, but he shall not cut the work of any other Contractor without first consulting the Architect. He shall repair any work damaged by him or his workmen, employing the services of the Contractor whose work is damaged. Saw cut existing slab as required for routing conduits and floor boxes noted to be installed in existing floors. Restore to original finish.

C. This Contractor shall by all means coordinate the location of ceiling lighting fixtures, both recessed and surface mounted, with the Ceiling Contractor so that proper hangers and supports shall be provided.

D. Any conflict between electrical and other trades shall be reported before construction starts. No extra charges will be approved for work resulting from failure to coordinate with other trades.

1.11 INSTALLATION:

A. Raceways, fixtures, devices, and other electrical equipment shall be installed in a neat and workmanlike manner and in accordance with recognized good practice for a first class installation.

B. The Architect or his representative shall have the authority to reject any workmanship not complying with the contract documents.

C. The Electrical Contractor shall personally or through an authorized licensed and competent electrician, constantly supervise the work from beginning to complete and final inspection.

D. Electrical equipment shall be installed in accordance with manufacturer's recommendations.

E. Locations of proposed raceway, riser, location of structural elements, location and size of chases method and type of construction of floors, walls, partitions, etc., shall be verified before construction starts.

F. Consult owner and utility companies for underground lines before any underground work is started. Contractors shall be responsible for any damage.

G. All empty conduits shall have a pull string installed. All flush recessed boxes shall have black plates installed.

1.12 EXCAVATION, TRENCHING AND BACKFILLING:

A. General. The Contractor shall perform all excavation to install conduit structures and equipment specified in this Division of the Specifications. During excavation, materials for backfilling shall be piled back from the banks of the trench to avoid over-loading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and other excavations and water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done. All requirements of OSHA shall be complied with.

B. Trench Excavation. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the conduit on undisturbed soil at every point along its entire length. Over depths shall be backfilled with loose, granular, moist earth, tamped. Removed unstable soil that is not capable of supporting the conduit and replace with specified material.

C. Backfilling. The trenches shall not be backfilled until it is reviewed by the Architect or his representative. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, and gravel or soft shale, free from large clods of earth or stones, deposited in 6" layers and tamped until the conduit has a cover of not less than the adjacent existing ground but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that conduit is not displaced. The compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material, except that trenches occurring under paved areas or in areas to be filled shall be backfilled in 6" maximum layers and each layer compacted to 95% maximum density. Settling the backfill with water will not be permitted. Any trenches not meeting compaction requirements or where settlement occurs shall have backfill removed down to the top of the conduit then backfill with approved materials as specified hereinbefore.

D. Positively no tree roots are to be damaged, hand dig where required. Damaged trees or shrubbery shall be replaced in kind and must be approved by Engineer.

1.13 MATERIALS:

A. Materials specified by manufacturer's name shall be used unless approval of other manufacturers are listed in addenda to these specifications. Request for prior approval shall be submitted by mail only. Facsimile will not be acceptable.

B. Drawings indicating proposed layout of space, all equipment to be installed therein and clearance between equipment shall be submitted, where substitution of materials alter space requirements on the drawings.

C. Material Standards: All materials shall be new and shall conform to the standards where such have been established for the particular material in question. Publications and Standards of the organization listed below are applicable to materials specified herein.

1. American Society for Testing and Materials (ASTM)
2. Underwriter's Laboratories, Inc. (UL)
3. National Electrical Manufacturer Association (NEMA)
4. Insulated Cable Engineers Association (ICEA)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. National Fire Protection Association (NFPA)
7. American National Standards Institute (ANSI)

D. Material of the same type shall be the product of one manufacturer.

E. Materials not readily available from local sources shall be ordered immediately upon approval.

F. The Architect shall have authority to reject any materials, or equipment, not complying with these specifications and have the Contractor replace materials so rejected immediately upon notification of rejection.

G. Any material or equipment so rejected shall be removed from the job within 24 hours of such rejection, otherwise the Architect may have same removed at the Contractor's expense.

1.14 EQUIPMENT CONNECTIONS:

A. All equipment requiring electrical power connections shall be connected under this Division of these specifications.

B. Where electrical connections to equipment require specific locations, such locations shall be obtained from shop drawings.

C. Drawings for location of conduit stub-up boxes mounted in wall or floor to serve specific equipment, shall not be scaled.

D. Electrical circuits to equipment furnished under other sections of these specifications are based on design loads. If actual equipment furnished has loads

other than design loads electrical circuits and protective devices shall be revised to be compatible with equipment furnished at no additional cost to the Owner. Any revisions must have prior approval by the Architect. Before submitting shop drawings, Electrical Sub-Contractor shall along with the Mechanical and Plumbing Sub-Contractor review voltage and load requirements for mechanical and plumbing equipment to determine the compatibility between what is being furnished and what is shown in the contract drawings. The Electrical Sub-Contractor shall along with his submittals submit a statement that he has reviewed all shop drawings including review with the Mechanical and Plumbing Sub-Contractors.

E. Where equipment is indicated to be served thru conduit stub-up, conduit shall be stubbed up not less than four inches above floor where transition shall be made to sealtite flexible conduit for connection to equipment.

F. The Contractor's attention is invited to other Divisions of these specifications, where equipment requiring electrical service or electrically related work is specified to become fully aware of the scope of work required for electrical service or related work.

G. Where electricity utilizing equipment is supplied separate from the electrical work, and is energized, controlled or otherwise made operative by electrical work, the testing to provide the proper functional performance of such wiring systems shall be conducted by the trade responsible for the equipment. The electrical work shall, however, include cooperation in such testing and the making available of any necessary testing or adjustments to the electrical equipment.

H. Heating, air conditioning, and ventilating equipment is specified to be furnished and installed under other sections of these specifications. The controls, likewise are specified to be furnished thereunder. All necessary wiring, wiring troughs and circuit breakers for power for this equipment shall be furnished and installed under this section of the specifications, in accordance with the plans and/or diagrams furnished with the equipment, or shown on these plans. Starters furnished by the Mechanical Contractor shall be installed under this Division of the specifications. Power wiring to auxiliary equipment on a piece of equipment remote from its main terminal box and interlocking of apparatus shall be accomplished under Heating Ventilating Equipment section of the specifications. Conduit and outlets for control wiring shall be furnished and installed under Division 15 of these specifications. Control conductors for mechanical equipment shall not be installed in same conduit with power conductors.

I. Contractor is to note that location of disconnect switches shown are schematic in nature. Exact location of disconnect switch and mounting height shall be coordinated with field conditions and equipment shop drawings. Locate disconnect as required to maintain clearances required by National Electrical Code.

J. Contractor shall provide a rooftop mounted, GFCI receptacle with weatherproof cover within 20’ of a rooftop mounted HVAC unit. Serve from closest receptacle circuit with ½”C., 3#12’s. See mechanical plan for unit locations.

1.15 PRODUCT DELIVERY, STORAGE, HANDLING, & PROTECTION

A. Inspect materials upon arrival at Project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material. Handle materials in accordance with manufacturer's applicable standards and suppliers recommendations, and in a manner to prevent damage to materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Containers which are broken, opened, damaged, or watermarked are unacceptable and shall be removed from the premises.

B. All material, except items specifically designed to be installed outdoors such as pad mounted transformers or stand-by generators, shall be stored in an enclosed, dry building or trailer. Areas for general storage shall be provided by the Contractor. Provide temperature and/or humidity control where applicable. No material for interior installation, including conductors, shall be stored other than in an enclosed weather tight structure. Equipment stored other than as specified above shall be removed from the premises.

C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Conditions shall be those for which the equipment or materials are designed to be installed. Equipment and materials shall be protected from water, direct sunlight, cold or heat. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

1.16 CLEANING AND PAINTING

A. Remove oil, dirt, grease and foreign materials from all raceways, fittings, boxes, panelboard trims and cabinets to provide a clean surface for painting. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trims, motor control center, switchboard or equipment enclosures with paint furnished by the equipment manufacturers specifically for that purpose.

B. Do not paint trim covers for flush mounted panelboards, telephone cabinets, pull boxes, junction boxes and control cabinet unless required by the Architect. Remove trim covers before painting. Under no conditions shall locks, latches or exposed trim clamps be painted.

C. Unless indicated on the drawings or specified herein to the contrary, all painting shall be done under the PAINTING Section of these Specifications.

D. Where plywood backboards are used to mount equipment provided under Division 16, paint backboards with two coats of light grey semi-gloss paint. Plywood shall be 3/4" fire rated plywood. Paint shall be fire retardant paint.

1.17 GUARANTEE:

A. Defective LED fixtures shall be replaced up-to-date of acceptance and shall be guaranteed for five (5) years.

B. All systems and component parts shall be guaranteed for two years from the date of final acceptance of the complete project. Defects found during this guaranteed period shall be promptly corrected at no additional cost to the Owner. Warranty covers all equipment provided an installed under Division 26.

1.18 SERVICE:

A. The electrical service and telephone/CATV service for this project has been coordinated between the Engineer and the Utility Company. However, before installing service conduit (underground or mast), Contractor shall contact Utility Company and verify voltage, location and type of service. Prior to rough-in, coordinate an on-site meeting with each Utility Company to review exact requirements. Submit letter of coordination to Engineer for review.

B. Where contract documents show a pad mount transformer provide by Utility Company, the following items shall be coordinated with Civil Plans, Architectural Plans, and Utility Company prior to rough-in.

1. Transformer pad locations shall be a minimum of 10’-0” from any building overhangs, canopies, exterior walls, balcony, exterior stairs and or walkways connected to the building.

2. Transformer pad edge shall be no less than 14’-0” from any door way.

3. Transformer pad edge shall be no less than 10’-0” from any windows or other openings.

4. If the building has an overhang, the 10’-0” clearance shall be measured from a point below the edge of the overhang only if the building is three (3) stories or less. If the building is four (4) stories or more, 10’-0” shall be measured from the outside building wall.

5. Fire escapes, outside stairs, and covered walkways attached to or between buildings, shall be considered part of the building.

Note: This information above has been obtained from the NFPA Section 450-27 and the Office of Insurance and Safety Fire Commissioner Chapter 120-3-3.

6. If required by Utility Company, Contractor shall provide concrete pad for transformer per Utility Company requirements.

7. Contractor shall install meter (provided by Utility Company) on a 6" channel iron set in concrete. Paint channel iron to match transformer. Install 1 ¼" galvanized rigid steel conduit from meter to transformer C.T. compartment.

8. Install a 1" galvanized rigid steel conduit from meter and stubbed up into Main Electrical Room for future energy management monitoring. Install pull string and cap conduit.

1.19 SCHEDULING OF OUTAGES

A. Electrical work requiring interruption of electrical power which would adversely affect the normal operation of the other portions of the Owner's property, shall be done at time other than normal working hours. Normal working hours shall be considered eight A.M. to five P.M. Monday through Friday.

B. Schedule all work requiring interruption of electrical power two weeks prior to actual shutdown. Submit schedule in writing to Architect indicating extent of system to be de-energized, date and time when power is intended to be interrupted, and date and time power will be restored. Schedule shall be subject to the review of the Architect and the Representative of the Owner.

END OF SECTION

SECTION 26 0003 - ELECTRICAL SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the preparation of Electrical Division 26 Shop Drawings, Product Data, Samples, and other submittals.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

B. All submittals shall be submitted in electronic format.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into indexed files incorporating submittal requirements of each single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information for EACH SECTION:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager/General Contractor.
    e. Name of Electrical Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Specification Section number and title.
    i. Indication of full or partial submittal.

D. Options: Identify options requiring selection by Architect.

E. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

F. 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 with approval notation from Architect's action stamp.

2.2 SUBMITTAL DATA

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. Mark each copy of each submittal to show which products and options are applicable.
2. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

3. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

4. Submit Product Data before or concurrent with Samples.

B. 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. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

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

D. Installer Certificates: Submit 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.

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 ENGINEER’S ACTION

A. Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it.

B. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

C. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

SECTION 26 0015 - FUSES

1.01 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature and technical data sufficient for the engineer to determine whether system function will be adversely affected, whether proposed fuses meet this specification, and whether they are equal in quality.

1.02 MANUFACTURERS

A. Acceptable manufacturers are:
1. Littelfuse
2. Cefco
3. Gould - Shawmut

1.03 EQUIPMENT/MATERIAL

A. All fuses rated 600 volts or less and used for main, feeder, or branch circuit protection with 200,000 ampere interrupting rating and shall be so labeled. Fuse classes and sizes indicated on the drawings have been selected to provide a fully coordinated selective protection system. To maintain this design, all fuses provided shall be furnished by the same manufacturer. Should equipment provided require a different U.L. Class or fuse size, the engineer shall be furnished with sufficient data to ascertain that system function will not be adversely affected.

B. Current-Limiting Fuses 601-6000 Amperes
Fuses rated over 600 amperes shall be U.L. Class "L" fuses, and shall have a minimum time delay of 10 seconds at 500% rating.

C. Spare Fuses
At the time of final acceptance, the contractor shall furnish the owner's representative, not less than three (3) spare fuses of each size and type installed.

END OF SECTION

SECTION 26 0020 - RACEWAYS

1.01 SUBMITTALS

A. Submit manufacturer's literature for each type of conduit or tubing and fittings used in the project.

1.02 MANUFACTURERS

A. Acceptable manufacturers of rigid steel and electrical metallic tubing conduit are:
1. Allied Tube and Conduit Co. (Kwik-Fit)
2. Wheatland Tube Co.
3. Triangle
4. L.T.V.
5. American Brass
6. E.T.P.
7. Robroy
8. PYTCO
9. RYMCO
10. Galvite

B. Acceptable manufacturer's of polyvinyl chloride (PVC) conduit are:
1. Certainteed
2. Georgia Pipe
3. Carlon
4. Can-Tex
5. Queen City

C. Acceptable manufacturer’s of conduit fittings, bushings, and locknuts are:
1. O-Z/Gedney
2. Thomas and Belts
3. Raco

1.03 MATERIALS

A. All metallic conduit and electric metallic tubing shall be steel, of standard pipe dimensions, smooth inside and out, and shall be galvanized. Where the word "conduit" is used hereinafter it shall mean either rigid steel conduit, electric metallic tubing, flexible steel conduit, liquid tight flexible steel conduit or schedule 40 plastic conduit. Intermediate grade conduit is not acceptable.

B. Galvanized rigid steel conduit shall be used in all areas where it will be exposed to physical damage. Schedule 40 plastic conduit shall be used underground and in slab-on-grade. In no case shall plastic conduit be exposed; switch to rigid steel conduit when turning up exposed. All other conduit, unless otherwise specified or called for on the plans, may be galvanized electric metallic tubing. Any exposed conduit on exterior of the building shall be galvanized rigid steel only.

C. Plastic conduit shall be made from virgin polyvinyl chloride C-300 compound. Conduit and fittings shall carry a UL label. Fitting and cement shall be produced by the same manufacturer as the conduit to assure system integrity.

D. All conduit shall be concealed in building construction except as noted or shown otherwise. In areas with no finished ceiling and where conduit is run exposed all runs down to switches, receptacles, etc. shall when possible be concealed in wall. It is the intent of these specifications that all conduit will be concealed whenever possible. Where outlets are required to be installed on existing walls in a finished space, raceway and outlet box shall be wiremold surface metal raceway.

E. EMT fittings shall be compression and made of steel for sizes two inches or smaller, steel set screw type fittings may be used on sizes 2 1/2" or larger. Connectors and couplings shall be rain tight and shall have a nylon insulated throat. All fittings shall be "UL" approved. EMT conduit (in sizes 2 ½" through 4") provided with integral steel compression or set screw coupling on one (1) end of the conduit is acceptable. Die cast, and indenter type fittings are not acceptable. Fittings for flexible steel conduits and liquid tight flexible conduit shall be steel and have nylon insulated throat.

F. Rigid steel conduit and EMT shall be not less than ½ inch trade size, schedule 40 plastic conduit shall not be less than 3/4" trade size and not less than required by the NEC or indicated. Conduit runs with more than 5 #12 conductors shall not be less than 3/4".

G. Conduit and EMT systems indicated on the drawings for communication and signaling systems are for typical systems. Install conduit and EMT systems for the system being installed.

H. Connect individual recessed lighting fixtures to the conduit or EMT system with "maximum 6'-0" flexible, galvanized steel conduit. Use flexible galvanized, steel metal conduit for final connection to all rotating equipment and transformers. The flexible conduits shall be long enough to permit the full range of required movements without strain and to prevent the transmission of vibration. Do not utilize flexible conduit to loop between fixtures and devices.

I. Galvanized rigid steel conduit couplings and connections:
   1. Install standard, conduit-threaded fittings.
   2. Ream the ends of conduits after cutting and threading them.
   3. For connection to sheet metal boxes, cabinets and other sheet metal enclosures, install locknuts on the inside and outside of the enclosure for each connection. See Section 16110 of these specifications.

J. EMT couplings and connectors:
   1. Ream the ends of EMT after cutting them.
   2. Install the following threadless type fittings:

      a. Connectors: steel compression type with insulated throat or steel tap-on type with insulated throat.

b. Couplings: steel compression or tap-on type.

K. Installation of plastic conduit:
1. Shall be installed in complete accordance with manufacturer's recommendations.
2. Shall be a minimum of 2'-0" below finished grade when not covered by concrete.
3. Shall have properly sized bond wire installed with all circuits.
4. Bends and turns shall be kept to a bare minimum.
5. Extreme care shall be taken to avoid crushing or cracking conduit. "DO NOT" run vehicles over exposed conduit under any conditions.
6. All conduit and fittings shall be solvent welded.
7. Plastic conduit maybe turned up in masonry walls only. PVC conduit shall be allowed to be routed concealed in masonry walls to a maximum height of 48" A.F.F.
8. Do not install conduit in slab. All conduit shall be installed a minimum of 6" below slab. Conduits shall not be bunched together. Maintain 1" clearance between conduits.
9. Plastic conduit shall not be bent with a propane torch or open flame. Contractor shall utilize a heat gun, heat blanket, or hot box. Plastic conduit bent with such shall not be scorched or marred.

L. Insulated bushings:
1. Install nylon insulated bushings on the end of all rigid conduit.
2. The insulating material shall be designed for rugged, long service.
3. Bushings which consist of only insulating material will not be accepted.
4. Fittings which incorporate insulated bushings will be considered for approval in lieu of fittings with separate bushings.

M. All couplings and connections in location where water or other liquid or vapor might contact the conduit and EMT shall also be watertight.

N. Close empty conduit and EMT as complete runs before pulling in the cables and wires.

O. Install exposed conduit and EMT parallel to or at right angles with the lines of the building. Locate them so they will not obstruct headroom or walkways or cause tripping.

P. Avoid bends or offsets where practicable:
1. Do not install more bends, offsets or equivalent in any conduit or EMT run than permitted by the NEC.
2. Make bends with standard conduit bending machines.
3. Conduit hickeys may be used for making slight offsets and for straightening conduits stubbed out of concrete.
4. Conduit or EMT bent with a pipe tee or vise will not be accepted.
5. Do not install crushed or deformed conduits or EMT.

Q. Install conduit or EMT clamps:

1. At intervals as required by the NEC.
2. Above suspended ceilings, metal supports may be installed as permitted by the NEC, except that conduit cannot be supported or secured to the T-bar grid or from the wire supporting the T-bar grid.
3. Trapeze, split ring, band or clevis hanger may be installed as permitted by the NEC. Trapeze hangers shall be structural metal channels, angle irons or preformed metal channel shapes with the conduit and EMT runs held on specific center by U bolts, clips or clamps. Do not support conduit from ceiling suspension wire or from other conduit.
4. Chain, wire or perforated strap supports will not be acceptable. Nor are they acceptable as a means of securing the conduit.
5. Fasten the clamps and other supports as follows:

    a. For new masonry or concrete structures, install threaded metal inserts prior to pouring the concrete.
    b. For existing solid masonry or reinforced concrete structures:

        1. Install expansion anchors and bolts or approved power-set fasteners.
        2. Expansion anchors and bolts shall be not less that 1/4 inch diameter and shall extend not less than 3 inches into the concrete or masonry.
        3. Power-set fasteners shall be not less than 1/4-inch diameter and shall extend not less than 1-1/4-inch into the concrete.

    c. For hollow masonry install toggle bolts. Bolts supported only by plaster will not be accepted.
    d. For metal structures install machine screws.
    e. Attachments to wood plug, rawl plug, soft metal insert or wood blocking will not be permitted.

R. For vertical runs of conduit of EMT:
1. Install supports for conduit, EMT, cables and wires at intervals as required by the NEC and as indicated on the drawings.
2. Conduit and EMT supports shall be supported by framing for the floors.

S. Conduits and EMT shall be kept 6" away from parallel runs of steam or hot water pipes.

T. Clogged raceways shall be entirely free of obstructions or shall be replaced.

U. Rigid steel conduit installed underground and in concrete shall be wrapped with Scotchwrap #50 corrosion protection tape.

V. All empty conduits shall have nylon pull cord installed to provide for installation of cables, conductors or wiring. All empty conduits stubbed out below grade shall have be capped and provided with a concrete marker. All spare conduits

stubbed up through slab shall have a cap installed to prevent debris from entering conduit.

W. Do not combine conduit homeruns. Each homerun shall be separately routed directly to panel unless specifically noted otherwise.

X. Install service conduit (TV, electrical, and telephone) as follows:

1. All underground entrances shall have metallic sleeves through building foundation walls and extend to undisturbed ground to avoid shear, and shall be full weight, threaded hot-dipped galvanized rigid steel conduit.
2. All 90 degree bends to be rigid metallic conduit, with a radius of not less than 10 times the diameter of the conduit.
3. Maintain a minimum cover of 24 inches below final grade for conduits.

Y. Do not install conduit in cavity between concrete block and brick. Conduit shall not be stubbed up into this cavity or routed horizontally in cavity.

Z. All feeder conduits 2” and larger which exceed 100’ in length shall have galvanized rigid steel 90 degree elbows.

END OF SECTION

SECTION 26 0030 - CONDUCTORS

1.01 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.02 MANUFACTURERS

A. Acceptable manufacturers are:

1.	General	6.	Cyprus Rome	13.	Colonial Wire
2.	Okonite	7.	Essex		
3.	Senator	8.	Carol		
4.	Triangle	9.	Southwire		
5.	Pirelli	10.	American		
11.	Cerro	12.	CME		

B. All wiring shall be manufactured in the United States.

1.03 MATERIALS

A. Ratings and sizes:

1. Shall be not less than indicated on the drawings and not less than required by the NEC.
2. Minimum size shall be No. 12 AWG copper provided the maximum voltage drops in the control circuits will not adversely affect the operation of the controls.
3. Conductor sizes indicated on the drawings are for copper conductors.

B. Conductors and ground wires:

1. Shall be copper.
2. Size No. 8 AWG and larger shall be stranded.
3. Size No. 10 AWG and smaller shall be solid.

C. Conductor insulation:

1. Conductor insulation shall be the NEC type THHN.

D. Wire shall be factory color coded in size No. 6 and smaller. Color shall be by integral pigmentation with a separate color for each phase, neutral and grounding conductor. Color code per phase shall be continuous throughout the project.

E. Manufacturer's name and other pertinent information shall be marked or molded clearly on the overall jacket's outside surface or incorporated on marker tapes within the cables and wires at reasonable intervals along the cables and wires.

F. Cables and wires indicated on the drawings for communication and signaling systems are for typical systems. Install cables and wires for the system being installed.

G. All wiring shall be in conduit unless specifically noted otherwise.

H. Every coil of wire shall be in the original wrapping and shall bear the Underwriters' Label of approval.

I. Where wires are left for connection to any fixture or an apparatus, spare wire or cables shall be provided at the ends for connections. Fixture connections at the outlet box shall be made with insulated wire connectors.

J. Outer jackets shall be color coded as follows:

1. Three phase or single phase circuits, 120/208 volts:

   a. Phase A - Black
   b. Phase B - Red
   c. Phase C - Blue
   d. Neutral - White
   e. Insulated ground wire - Green

2. Dedicated neutrals shall be provided for all multi-wire branch circuits and outer jacket shall be provided with appropriate colored tracer.

   a. 120/208V: white with red tracer, white with blue tracer, white with black tracer.

3. Only for large power cables and wires which do not have color coded jackets: No. 6 and larger.

   a. Install bands of adhesive non-fading colored tape or slip-on bands of colored plastic tubing over the cables and wires at their originating and terminations points and at all outlets of junction boxes.
   b. Color shall be permanent and shall withstand cleanings.

K. Wiring for signal circuits shall conform to the recommendations of manufacturers of the signal system being installed so the system shall have optimum performance and maximum service continuity. Communication and signaling circuit wiring where run in conduit below grade or in a damp location shall be listed for use in a damp or wet location. Communication and signaling conductors not in conduit shall be rated for plenum use.

L. No circuit wiring shall be smaller than number 12. Where the homerun exceeds 100'-0" in length, number 10 (minimum) wire shall be used even though all such circuits are not indicated on the plans.

M. When installing THHN extra care must be exercised so as not to damage nylon jacket. When nylon jacket is damaged wiring shall be removed from service, and replaced with new conductors.

END OF SECTION

SECTION 26 0040 - OUTLETS

1.01 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.02 MANUFACTURERS

A. Acceptable manufacturers are:
   1. Raco
   2. Steel City
   3. Appleton
   4. Hubbell

1.03 MATERIALS

A. Boxes shall be galvanized pressed sheet steel for all concealed work.
B. Where conduit runs are exposed, outlet shall be of the cast metal type.
C. For concealed work each box shall be provided with a square cornered plaster ring.
D. Each surface lighting fixture, receptacle and switch shall be provided with flush mounted outlet box. All outlets installed in panels and other architectural features shall be centered. The location of any outlet may be moved as much as 10'-0" by the Architect before the outlet is placed without incurring any extra cost. All dimensions refer to the finished floor line. Outlet boxes shall be pressed sheet steel and shall be galvanized for all concealed work. Where conduit runs are exposed outlets shall be of the cast metal type.
E. Boxes shall be for the service and the type of outlet and shall not be less than 4" square and 1-1/2" deep except where otherwise specified. Boxes installed in walls shall be provided with a square cornered 1-1/2" plaster ring installed flush with surface of wall. Coordinate depth of plaster ring required for particular wall construction. Each outlet box above ceiling shall be supported from a structural member of the building either directly or by using a substantial and approved metal support. Conduit is not an approved means of support. Boxes installed in wall shall be supported either directly to a stud or between studs utilizing an approved bar hanger. In no case shall switch box support and clips used for mounting boxes in old work be used unless specifically called for. Top of outlet box shall be level.
F. All ceiling or wall recessed outlet boxes or their associated plaster rings shall be flush with the finished surface. Using coverplate to secure wiring devices or shimming the device is not acceptable. Contractor shall exercise due care when cutting opening in walls or ceilings for outlet boxes so that opening size will permit the proper installation of boxes and devices. Fixture studs in ceilings and bracket outlets shall be bolted with stove bolts or shall be locking type of stud mounting.
G. In addition to boxes indicated, install enough boxes to prevent damage to cables and wires during pulling-in operations.

H. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

I. "There shall be no outlets installed back to back. A minimum of 4" shall separate each outlet."

J. Where the volume allowed per conductor exceeds that allowed in Table 370-6(b) of the NEC for the minimum size outlet specified, a larger size outlet box shall be used and shall be sized in accordance with the table noted above.

K. Outlet boxes shall be clean and free from dust, paint, dirt, plaster ready mix joint compound and /or any other debris.

1.04 LABELING AND IDENTIFICATION

A. All junction box cover plates shall be labeled identifying the system it contains. The label shall be neatly hand written with a wide tip permanent non-removable marker and be easily identified. Junction boxes containing high voltage wiring shall include panel and circuit designation (ex. HA - 1,3,5 or LA – 2,4,6). Junction boxes utilized for low voltage system shall be labeled in accordance with the system (ex. FA for Fire Alarm System).

END OF SECTION

SECTION 26 0050 - WIRING DEVICES AND DEVICE PLATE

1.01 SUBMITTALS

A. Submit product data under provisions of Section 260000, GENERAL.
B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

1.02 REFERENCES

A. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
B. FS W-S-896 - Switch, Toggle.
C. NEMA WD 1 - General-Purpose Wiring Devices.
D. NEMA WD 5 - Specific-Purpose Wiring Devices.

1.03 MANUFACTURERS

A. For the purpose of selecting quality and type of device, equipment manufactured by Hubbell has been specified. The following manufacturers meeting this specification are acceptable:

1. Pass and Seymour
2. Cooper
3. Leviton

1.04 PRODUCTS

A. Switches: All wall switches shall be rated 20 ampere, 120/277 volts, have self grounding provisions, side wiring only and shall be of the silent type. Color shall be gray. Where shown connected to emergency power circuits, provide red switch.

1. Single pole: HBL 1221.
2. Double pole single throw: HBL 1222.
3. Three way: HBL 1223.
4. Four way: HBL 1224.
5. Key switch single pole HBL 1221l, three-way: HBL 1223L, four-way: HBL 1234L. Three way and four way key switches shall be keyed alike.
6. Single pole, pilot light, red handle (lit in “on” position): HBL 1297.
7. Despard single pole switches installed in mullions. Pass & Seymour ACD 201.

B. Receptacle: All receptacles shall be of the Tamper Resistant (TR) grounding type, of the configuration shown on the drawings and shall be flush wall mounting type. Color shall be gray.

1. Standard duplex receptacle: 20 ampere, 125 volt, NEMA type 5-20 R, 2 pole, 3 wire, straight blade, U-grounding slot, Tamper Resistant (TR) rated, specification grade. HBL 5362. (TR)
2. Power, receptacle with matching plug: 20 ampere, 125/250 volt, NEMA type 14-20, 3 pole 4 wire grounded, straight blade type. HBL 8410.
3. Power receptacle with matching plug: 20 ampere, 250 volt, NEMA type 6-20R 2-pole, 3 wire grounded, straight blade type. HBL 5462.
4. Power receptacle with matching plug: 30 ampere, 250 volt, NEMA type 6-30R 2-pole, 3 wire, u-grounded slot, straight blade type. HBL 9330.
5. Power receptacle with matching plug: 50 ampere, 125/250 volt, NEMA type 14-50R, 3-pole, 4 wire grounded, straight blade type. HBL 9450A.
6. Ground fault interrupter receptacle: Tamper Resistant (TR) rated, 20 ampere, 125 volts, NEMA type 5-20R, 2-pole, 3-wire with grounded U slot. GF 5262.(TR)

C. Device plates: Plates shall be furnished for all devices and outlets indicated on the drawings (telephone, computer, TV, etc.). All plates on masonry walls shall be oversized jumbo type.

1. Flush mounted plates: Beveled type with smooth rolled outer edge, stainless steel type 302 with brushed finish.
2. Surface box plates, beveled, galvanized steel, pressure formed for smooth edge to fit box.
3. Die cast weatherproof cover. Lockable hasp vertical mounting. Intermatic #WP1010MC.

1.05 INSTALLATION

A. Switches:

1. Switches shall be connected to the live side of the circuit and shall control only the outlets indicated.
2. Conductors shall be looped around the terminal screw.
3. Where more than one switch is indicated in the same location switches shall be gang mounted under a common plate.
4. Where multi-wire switching (360 volt potential) occurs, a barrier shall be provided between switches.
5. Center line of switches in general, shall be set 3'-6" above the floor (off position down) and shall clear the door trim or corner by 4" or center the space occupied.
6. Architectural plans shall be consulted before placing switches so they will in every case be located on the strike side of the door and clear door, chair, window, and baseboard moldings.

7. Switches shall be screwed tight to the boxes and shall not depend on the cover plate to pull them tight.

B. Receptacles:

1. Conductors shall be looped around the terminal screws, "DO NOT BACK WIRE DEVICES."
2. Receptacles shall be grounded by the green wire bond and shall be pigtailed as shown on the drawings.
3. Receptacles shall be screwed tight to the plaster ring or outlet box and shall not depend on the device plate to pull them tight.
4. Center line of general use receptacles shall be in general, set 18" above the floor with receptacle mounted in the vertical position and with grounding pole at the bottom.
5. Coordinate receptacle height with Architectural drawings and locate so that bottom of receptacle plate shall be 1" above counter or back splash and clear all moldings.
6. Center line of receptacles located adjacent to lavatories in toilets shall be set 3'-6" above floor.
7. Receptacles serving water coolers shall be located within cooler housing or as close to bottom of housing as possible. Cord serving unit shall be as short as possible. In no case shall cord or receptacle be seen from normal viewing angle.
8. All receptacles installed in bathrooms, toilets, within 6 feet of lavatories or sinks or on building exterior shall be ground fault circuit interrupter type.
9. All receptacles installed in kitchens or outdoors shall be GFCI type.

C. Plates:

1. Plates shall be level and all edges shall be in full contact with wall.
2. Plates shall be furnished for all devices and other outlets indicated on the drawings.
3. Install plates on outlet boxes and junction boxes in unfinished areas above ceilings and on surface mounted outlets.
4. Plates shall not be used to keep devices secure.
5. Plates shall be clean and free from dust, plaster or paint and spots.
6. Plate shall cover openings around outlets.

END OF SECTION

SECTION 26 0060 - LED INTERIOR 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. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260065 for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260090 "Lighting Control System" for panelboards used for lighting control.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

6. Photometric data and adjustment factors based on laboratory tests[, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project] [IES LM-79] [and] [IES LM-80].

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all fixture/lamp types used on Project; use ANSI and manufacturers' codes.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIMENTS

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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. Bulb shape complying with ANSI C79.1.

E. Lamp base complying with ANSI C81.61 or IEC 60061-1.

F. CRI of 80. CCT of 4000 K.

G. Rated lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Internal driver.

J. Nominal Operating Voltage: 120 V ac or 277 V ac.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

K. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear powder-coat finish.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. 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.

C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear powder-coat painted finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels 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 characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 14 gage.

C. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
2. Ceiling mount with pendant mount with 5/32-inch diameter aircraft cable supports adjustable to 120 inches in length.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing, rod or wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of two (2) locations, at opposite corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of two (2) locations, located at diagonal corners of luminaire.
4. Provide two (2) fixture support wires attached at diagonal corners of lay in fixtures. Attach these two (2) support wires to structure above.

J. Flexible conduit and wiring from outlet box to fixture shall be minimum 3/8"C., and minimum #18 THHN conductors. Factory supplied whips of smaller ratings are not acceptable. Where 0-10 volt dimming is utilized, use #18 (TJP), grey/purple jacketed conductor integral to flex.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 01 20 “Equipment Identification."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 26 0070 - DISCONNECT SWITCHES

1.01 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.02 MANUFACTURERS

A. Acceptable manufacturers are:
   1. Square "D" Company
   2. G. E.
   3. Siemens
   4. Cutler Hammer

1.03 EQUIPMENT

A. Disconnect switches shall be provided for all motors and strip heaters located out of sight of motor controller, and where specifically indicated on the drawings. Disconnect switches shall disconnect all ungrounded conductors. When exposed to weather, enclosure shall be NEMA - 3R. Switches shall be installed to be fully accessible in accordance with Article 110-26 of the National Electrical Code.

B. All disconnects shall be heavy duty type and shall be equipped with factory installed equipment ground kit bonded to the can for grounding purposes.

C. For single phase motors, a single - or double-pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Enclosed safety switches shall be horsepower rated in conformance with Table III of Fed. Spec. W-D-865. Switches shall disconnect all ungrounded conductors.

D. Each disconnect serving ground mounted exterior A/C units shall be equipped with a padlock (Master 3206) all keyed alike.

E. All disconnects shall be equipped with provisions to lock the handle in the OFF position.

F. All disconnects shall be fusible type, fused in accordance with the name plate data on the unit. Disconnects serving water heaters or resistance heat strips shall be fused at 125% of the full load amps of the unit.

G. Install fuses so that ampere rating can be read without having to remove fuses.

H. All fuses shall be as noted in Section 26 0015.

I. Disconnects shall be identified as required under Section 26 0120.

J. Maintain 3'-0" clearance in front of disconnect having voltage rating of 250 volts and 4'-0" clearance in front of disconnect having voltage rating of 480 volts. Do not locate disconnect over other electrical equipment (i.e.: transformers). See 26 0000-1.14-I.

END OF SECTION

SECTION 26 0100 - PULL BOXES AND JUNCTION BOXES AND FITTINGS

1.01 PULL BOXES AND JUNCTION BOXES AND FITTINGS

A. Boxes shall be provided in the raceway systems wherever required for the pulling of wires and the making of connections.

B. Pull boxes of not less than the minimum size required by the National Electrical Code Article 370 shall be constructed of code-gauge galvanized sheet steel. Boxes shall be furnished with screw-fastened covers. Covers on flush wall mounted boxes in well appointed areas (offices, reception, classrooms, media center, etc) shall be minimum 1/16 302 stainless steel. Boxes located on the exterior of the building shall be watertight. Covers shall be secured with tamper proof screws.

C. Boxes shall be securely and rigidly fastened to the surface of which they are mounted or shall be supported from structural member of the building either directly or by using a substantial and approved metal rod or brace.

D. All boxes shall be so installed that the wiring contained in them can be rendered accessible without removing part of the building.

E. Where several circuits pass through a common pull box, the circuits shall be tagged to indicate clearly their electrical characteristics, circuit number and designation.

F. All junction boxes larger than 4" x 4" flush mounted in wall shall have overlapping cover plate to cover rough-in openings.

END OF SECTION

SECTION 26 0110 - GROUNDING

PART 1 GENERAL:

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The work required under this section of the specifications consists of furnishing, installation and connections of the building secondary grounding systems. Exterior branch circuit wiring and feeder conductors extended beyond the building are included. The building electrical system shall be a 3 phase, 4 wire grounded wye delta system supplemented with equipment grounding system. Equipment grounding system shall be established with equipment grounding conductors; the use of metallic raceways for equipment grounding is not acceptable.

1.03 QUALITY ASSURANCE

A. Industry Referenced Standards: The following specifications and standards are incorporated into and become a part of this Specification by Reference.

1. Underwriters' Laboratories, Inc. (UL) Publications:
No.44 Rubber-Insulated Wire & Cables
No.83 Thermoplastic-Insulated Wires
No.467 Electrical Grounding & Bonding Equipment
No.493 Thermoplastic-Insulated Underground Feeder & Branch Circuit Cables
No.486 Wire Connectors and Soldering Lugs

2. National Electrical Manufacturers' Standards (NEMA):
WC-5 Thermoplastic Insulated Wire & Cable
WC-7 Cross-Linked-Thermosetting Polyethylene Insulated Wire

3. National Fire Protection Association Publication (NFPA):
No.70 National Electrical Code (NEC)

B. Acceptable Manufacturers: Products produced by the following manufacturer which conform to this specification are acceptable.

1. Hydraulically applied conductor terminations:

a. Square D
b. Burndy
c. Ilsco

d. Scotch (3M)
e. Thomas and Betts (T&B)
f. Anderson

2. Mechanically applied (crimp) conductor terminations:

a. Scotch (3M)
b. Ideal
c. Thomas and Betts (T&B)
d. Burndy

PART 2 PRODUCTS:

2.01 GENERAL MATERIALS REQUIREMENTS

A. Provide all materials under this section of the specifications. All materials shall be new.
B. All materials shall be UL listed and bear a UL label.
C. Refer to the specific specification section for the description and requirements of materials mentioned herein for installation.

2.02 GROUNDING CONDUCTORS

A. Grounding electrode conductor shall be bare or green insulated copper conductor sized as indicated on the drawings.
B. Equipment grounding conductors shall be green insulated type THHN conductors sized as indicated on the drawings. Where size is not indicated on the drawings, conductor size shall be determined from the National Electrical Code table of sizes of equipment grounding conductors.
C. Bonding jumpers shall be flexible copper bonding jumpers sized in accordance with the National Electrical Code table on sizes of equipment grounding electrode conductors.

2.03 TRANSFORMERS & MOTOR CONTROLLERS

A. Provide a conductor termination grounding lug bonded to the enclosure of each transformer and motor controller.
B. Provide an equipment ground bar with bonding screw in each disconnect for grounding purposes.

2.04 DEVICES

A. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame. Bond equipment grounding conductor to each outlet box. For isolated ground receptacles, bond equipment grounding conductor to box, and isolated ground conductor to device grounding screw.

2.05 GROUND RODS

A. Ground rods shall be 3/4" x 10'-0" copper clad steel. Connection to all ground rods shall be by exothermic weld.

PART 3 EXECUTION

3.01 INSTALLATION

A. Ground all non-current carrying parts of the electrical system, i.e., wireways, equipment enclosures and frames, junction and outlet boxes, machine frames and other conductive items in close proximity with electrical circuits, to provide a low impedance path for potential grounded faults.

B. Service entrance and separately derived electrical systems, grounding electrode system.

1. The neutral conductor of the electrical service serving the premises wiring system shall be grounded to the ground bus bar in the service equipment which shall be grounded to the cold water system, the ground rod system, and other grounding electrodes specified herein or indicated on the drawings. Grounding electrode conductors shall be installed in rigid, non-metallic conduit to point of ground connection, unless subject to physical damage in which case they shall be installed in galvanized rigid steel. Where metallic conduit is permitted, bond conduit at both ends to grounding electrode conductor with a UL bonding bushing.

2. Make connection to main water line, and fire sprinkler piping entering the building. Make connections ahead of any valve or fittings whose removal may interrupt ground continuity. Install a bonding jumper of the same size as the grounding conductor around the water meter.

3. Bond together the following systems to form the grounding electrode system. All system connections shall be made as close as possible to the service entrance equipment and each connected at the service entrance equipment ground bus. Do not connect electrode systems together except at ground bus.

a. Cold water piping system
b. Ground rod system
c. Structural steel metal building frame, see detail on drawings
d. Main re-bar in a foundation footing
e. Fire sprinkler piping

4. Ground the neutral of all dry type transformers as indicated on the drawings.

5. Grounding electrode connections to structural steel, reinforcing bars, ground rods, or where indicated on the drawings shall be with chemical exothermic weld connection devices recommended for the particular

connection type. Connections to piping shall be with UL listed mechanical ground clamps.

6. Bonding shall be in accordance with the National Electrical Code.

7. Install ground rods where indicated on the drawings with the top of the ground rods 12" below finished grade.

C. Equipment Grounding Conductor

1. Grounding conductors shall be provided in all branch circuit raceways and cables. Grounding conductors shall be the same AWG size as branch circuit conductors.

2. Grounding conductors for feeders are typically indicated on the drawings and the raceway is sized to accommodate grounding conductor shown. Where grounding conductor size is not indicated on the drawings, conductor shall be in accordance with the equipment grounding conductor table of the National Electrical Code.

3. A grounding conductor shall be installed in all flexible conduit installations. For branch circuits, grounding conductor shall be sized to match branch circuit conductors.

4. A feeder serving several panelboards shall have a continuous grounding conductor which shall be connected to each related cabinet grounding bar.

5. The equipment grounding conductor shall be attached to equipment with bolt or sheet metal screw used for no other purpose. Where grounding conductor is stranded, attachment shall be made with lug attached to grounding conductor with crimping tools.

6. Ground all motors by drilling and tapping the bottom of the motor junction box with a round head bolt used for no other purpose. Conductor attachment shall be through the use of a lug attached to conductor with a crimping tool.

7. Equipment grounding conductors shall terminate on panelboard, switchboard, or motor control center grounding bus only. Do not terminate on neutral bus. Provide a single terminals lug for each conductor. Conductor shall terminate the same section as the phase conductors originate. Do not terminate neutral conductors on the ground bus.

C. Other Grounding Requirements

1. Each telephone backboard and data network rack shall be provided with a No.6 grounding conductor. Ground conductor shall be routed to

ground bar in nearest panel. Terminate conductor by stapling to backboard. Provide 6' slack conductor. If conductor is routed in a metal conduit, provide a grounding bushing at conduit end and bond to lug on ground bushing.

2. Lighting fixtures shall be grounded with a green insulated ground wire secured to the fixture with a UL listed bond lug, screw, or clip specifically made for such use.

3.02 TESTING

A. Upon completion of the ground rod installation, grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within forty-eight hours of rainfall. Results of ground resistance readings shall be forwarded, in writing, immediately to the Architect and Owner.

END OF SECTION

SECTION 26 0120 - EQUIPMENT IDENTIFICATION

1.01 SUBMITTALS

A. Submit sample of laminated plastic identification plate with lettering.

1.02 MATERIALS

A. Laminated plastic plates with 3/16" high white letter etched on black background.

B. Plates shall be permanently mounted utilizing pop rivets or a permanent mastic/epoxy.

C. Painted, stenciled or indented tape identification is not acceptable.

1.03 ITEM IDENTIFICATION

A. All electrical apparatus such as wiring troughs, panelboards, individual circuit breakers, transformers and disconnect switches shall have laminated plastic identification plates. Identification shall match labeling shown on plans.

B. A "steel" circuit directory frame permanently attached at factory (not glued), and a directory card with a plastic covering shall be provided on the inside of each panel door. The directory shall be typed to identify the load fed by each circuit and the areas served. Spaces or room numbers shown on the drawings are not necessarily the final numbers to be assigned to these areas. The Contractors shall before completion of the project obtain from the Architect final space or room numbers so that it can be typed onto directory.

C. Circuit breakers and disconnects shall identify the equipment served and circuit and panel from which it is served.

D. On all panelboards the exterior identification plate shall match that on the drawings and the panel and circuit number serving the panel shall be designated within the panel.

E. Provide laminated plastic label at individual breakers on power panelboards (I-Line) and switchboards. Indicate breaker number and designation of load served.

F. See Section 260040-1.04-A for required labeling of all junction box covers.

END OF SECTION

SECTION 26 0130 - DATA OR VOICE CONDUIT AND OUTLET SYSTEM

1.01 CONDUIT SYSTEM

A. Provide a complete system of conduits and outlet boxes for data and voice wiring. Each data or voice outlet shall have a 1" conduit routed from the flushed recessed outlet box up to the accessible ceiling space above. Turn conduit out above ceiling with a 90° horizontal elbow and terminate with an insulated bushing. Where ceiling finish is exposed structure (i.e. no acoustical tile ceiling), extend conduit to an area with an accessible gypboard/acoustical ceiling. Provide nylon pull string in conduit.

B. All conduit and outlet boxes shall be for data and voice cable only. Joint use with sound systems, fire, telephone, etc. it is not acceptable.

C. Location of outlets shall be as shown on the drawings.

D. Height of wall outlets shall be as noted on the drawings. All wall outlet boxes in new construction shall be two gang type, 4" x 4" x 2 1/8" deep, with single gang plaster rings. Plaster rings shall be flush with finish of wall. Coordinate depth of plaster ring required with type of wall construction.

E. Install a quaduplex receptacle at the telephone backboard and serve with a dedicated 20 ampere 120 volt circuit. The telephone shall consist of one - 3/4" x 4' x 8' plywood. Paint all sides and edges to match room finish. Install a #6 ground conductor from the nearest ground bar in panel, provide 8'-0" of coiled slack at board. Plywood shall be fire rated. Paint shall be fire retardant.

F. See site plan for routing of telephone service conduit. Prior to routing of conduit, coordinate an on-site meeting with local utility company to determine exact location. Provide a 200 pound minimum pull strength nylon cord in the service conduit. Cap off any conduit not utilized.

G. Each data network rack shall be grounded with a #6 copper routed in ½" conduit to the ground bar in the nearest panel. If conduit is metal, provide grounding bushings at each end of conduit. Provide a quadruplex receptacle at each data network rack and serve from a dedicated 20 amp, 120 volt circuit.

H. Conduit and its installation shall be as covered under Section 26 0020 of these specifications.

I. Outlets and their installation shall be covered under Section 26 0040 of these specifications.

J. All conduit shall be concealed unless otherwise noted.

K. Provide 302 jumbo stainless steel blank wall plates for all outlets not cabled.

END OF SECTION

SECTION 26 0140 - FIRE ALARM SYSTEM

1.01 SUMMARY

A. Section Includes:
   1. System smoke detectors.
   2. Heat detectors.

1.02 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.03 SUBMITTALS REQUIRED

A. General Submittal Requirements:

   1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
   2. Shop Drawings shall be prepared by persons with the following qualifications:

      a. Trained and certified by manufacturer in fire-alarm system design.
      b. NICET-certified fire-alarm technician.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

   1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
   2. Include voltage drop calculations for notification appliance circuits.
   3. Include battery-size calculations.
   4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
   5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
   6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
   7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

1.04 GENERAL REQUIREMENTS

A. The alarm equipment and all wiring shall be installed and interconnected by a factory certified installer and placed in working order. The name of the manufacturer and serial or identification numbers shall appear on all major components. Electrical supervision of the system shall conform to provisions of Article 240. NFPA Standard 72. Corresponding parts of all similar type equipment units shall be interchangeable, and locks for all cabinets shall be keyed alike. All devices, equipment and combination thereof shall be of the manufacturer's current production. All component parts of the system and the control unit shall be approved for the purpose intended. The stamp, label, seal or certificate of the Underwriter's Laboratories or the Factory Mutual Laboratories shall be considered as acceptable evidence of such approval.

B. Fire Alarm Subcontractor shall submit a certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service within 12 normal working hours.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm technician.

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.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of control panel, devices, or related equipment related to operation of system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two(2) years from date of Substantial Completion.

1.07 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion.

1. Provide 30 days' notice to Owner to allow scheduling and access to system.

1.08 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 as noted on drawings.

1.06 INSTALLATION

A. A qualified fire alarm technician shall install, adjust and test the equipment. The technician shall be qualified by training and experience in the installation and operation of the fire alarm system specified. The technician shall instruct operating personnel in the operation, adjustment and maintenance of the system. A statement signed by the person or persons instructed shall be supplied to the Architect prior to final operation.

B. Provide a written certification that the system is in complete and proper working order and in compliance with all codes.

1.07 SYSTEM OPERATION

A. Operation of any manual or automatic initiating device shall cause a general alarm to sound.

B. Also circuits and audible sounding devices shall be electrically supervised. In the event of an open circuit or ground in the system, loss of operation of supervisory power, or other supervised component failure, a trouble signal shall be actuated until the system is restored to normal. A silencing switch shall be provided for silencing the trouble alarm.

C. The system shall operate from one 120 volt circuit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Notifier
2. Edwards/EST
3. Fire Control Instruments, Inc.; a Honeywell company

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Release fire and smoke doors held open by magnetic door holders.

5. Activate voice/alarm communication system.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Activate emergency shutoffs for gas and fuel supplies.
9. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Connect devices to fire alarm control panel installed in Phase2.

2.04 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

3. Each detector shall have flashing LED for operational walk check.

2.05 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated. Fixed temperature of 200 deg F when required (i.e. kitchen).

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.

4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

F. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

I. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

J. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

K. All fire alarm system conductors shall be installed in conduit. All fire alarm conduit and back boxes shall be red.

L. Each fire alarm circuit shall be protected from lightning by installing surge protection devices either internally or externally. Circuits run between buildings shall be individually protected in addition to protection at control panel.

M. 20A/1P breaker serving fire alarm control panel is required to be locked in the “on” position and label with red lettering. Contractor shall provide “lock out” device on 20A/1P breaker serving fire alarm control panel.

N. Where a post indicator valve for fire sprinkler system is provided, Contractor shall provide a fire alarm system connection to tamper switch. Connection to such shall be waterproof. Provide lightning/surge protection devices at conductors serving such. Refer to civil plan for exact location of post indicator valve.

O. Number and size of conductors shall be as required by manufacturer of system being installed. Any cable run in conduit below grade shall be moisture proof, cable shall be equal to West Penn Aqua seal.

P. At time of final inspection, Contractor shall turn over a red-lined set of plans showing device location, device address, and device descriptor. Panel shall be fully programmed to denote location of addressable device. Provide a written report denoting that all fire alarm devices have been tested and are operable.

3.02 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 8 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.
2. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
3. Supervisory connections at valve supervisory switches..
4. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
5. Supervisory connections at fire-pump engine control panel.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.04 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.05 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect authorities having jurisdiction.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

SECTION 26 0175 - FIRESTOPPING

1.01 RELATED DOCUMENTS

A. The requirements of the general conditions, supplementary conditions, and division 1, general requirements, apply to Work in this Section.

1.02 DESCRIPTION

A. This Section describes the requirements for furnishing and installing firestopping for fire-rated construction. This includes:

1. All openings in fire-rated floors and wall assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, etc.

1.03 REFERENCES

A. ASTM E 814: "Standard Method of Fire Tests of Through-Penetration Firestops"
B. UL 1479, UBC 7-5: (both are same as A above)
C. ASTM E 119: "Standard Method of Fire Tests of Building Construction and Materials"
D. UL263, UBC 7-1: (both are same as C above)
E. UL 2079: "Standard for Tests for the Fire Resistance of Building Joint Systems"
F. Published Through-Penetration Systems by recognized independent testing agencies.

1. UL Fire Resistance Directory.
2. Warnock Hersey Certification Listings, current year.

1.04 QUALITY ASSURANCE

A. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM 814, UL 1479 or UL 2079. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating, when required by code authority, shall be based on the measurement of the temperature rise on the penetrating item(s). The fire test pressure differential of a minimum 0.01 inches of water column is required.

B. Fire stopping products shall be asbestos free, free of any PCBs and free of any lead.

C. Do not use any product containing solvents, or that require hazardous waste disposal.

1.05 SUBMITTALS

A. Submit manufacturer's product literature for each type of Firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance, limitation criteria and test data.

B. Submit manufacturer's Warranty.

C. Material Safety Data Sheets: Submit MSDS for each firestop product.

D. Shop Drawings: Show typical installation details for methods of installation. Indicate which firestop materials will be used where and thickness for different hourly ratings.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in the manufacturers' original, unopened containers or packages with manufacturers' name, product identification, lot number, UL or Warnock Hersey labels, and mixing and installation instructions, as applicable.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.

C. All firestop materials shall be installed prior to expiration of shelf life.

1.07 PROJECT CONDITIONS

A. Verify existing conditions and substrates before starting work.

B. Do not use materials that are based on organic solvents.

C. During installation, provide masking and drop cloths to prevent firestopping products from contaminating any adjacent surfaces.

D. Conform to ventilation requirements by manufacturer's installation instructions or Material Safety Data Sheet.

E. Weather Conditions: Do not proceed with installation of firestop products when temperatures are in excess of or below the manufacturer's recommendations.

F. Schedule installation of firestop products after completion of penetration item installation but prior to covering or concealing of openings.

G. Coordinate this work with work of other trades.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following manufacturers as shown below and further defined by the materials listed in Part 2.02 of this section.

1. The RectorSeal Corporation. Products as listed are a standard of generic types.
2. International Protective Coatings
3. 3M Company
4. Hilti

2.02 MATERIALS

A. Firestop Mortars:

1. Metacaulk Fire Rated Mortar by The RectorSeal Corporation
2. KBS Mortar by International Protective Coatings
3. HILTI FS635 Firestop Compound

B. Firestop Sealants and Caulks:

1. Metacaulk 950 by The RectorSeal Corporation
2. Metacaulk 835 by The RectorSeal Corporation
3. Metacaulk 805 by The RectorSeal Corporation
4. Metacaulk 1000 by The RectorSeal Corporation
5. CP 25WB+Caulk by 3M
6. Flame-Safe FS900 Series by International Protective Coatings.
7. HILTI FS-One Intumescent Firestop Sealant

C. Firestop Putty:

1. Metacaulk Fire Rated Putty by The RectorSeal Corporation
2. Metacaulk Fire Rated Putty pads by The RectorSeal Corporation
3. MPS-2 Moldable Putty Stix by 3M
4. MPP-4S Moldable Putty Pads by 3M
5. HILTI CP618 Firestop Putty

D. Firestop Sleeves:

1. Metacaulk Pipe Collars by The RectorSeal Corporation
2. Plastic Pipe Devices by 3M
3. HILTI CP6421643 Firestop Collar

E. Intumescent Wrap Strips:

1. Metacaulk Wrap Strip by The RectorSeal Corporation
2. FS-195 Wrap Strip by 3M
3. HILTI

F. Firestop Mastic:

1. Metacaulk 1100 by The RectorSeal Corporation
2. HILTI
3. 3M

G. Accessories:

1. Forming/Damming Materials: Mineral Fiberboard or other type recommended by manufacturer.
2. Primer, sealant and solvent cleaner: As recommended by firestop manufacturer.

H. Where subject to movement, firestop products used shall remain flexible to allow for such normal movement of building structure and penetrating item(s) without affecting the integrity of the firestop system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to proper and timely completion of the work.
B. Verify the penetrating item(s) are permanently installed and construction of fire rated assemblies are completed prior to firestop installation.
C. Prior to installation of firestop systems, clean surfaces of penetrating item(s) that will be in contact with firestop materials. Do not use any cleaning material that will either attack penetrating item(s) or firestop product to be installed.

3.02 CONDITIONS REQUIRING FIRESTOPPING

A. General:

1. Provide fire stopping for conditions specified whether or not firestopping is indicated, and, if indicated, whether such material is designated as insulation, safing or otherwise.
2. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.

B. Penetrations:

1. Penetrations include conduit, cable, wire, or other elements which pass through one or both outer surfaces of a fire rated floor, wall, or partition.
2. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814 (UL 1479).
3. These requirements for penetrations shall apply whether or not sleeves have been provided. Firestop the annular space between sleeve and surrounding surfaces.

C. Provide firestopping to fill miscellaneous voids and openings in fire rated construction in a manner essentially the same as specified herein before.

D. All junction boxes larger than 4' x 4" located in a rated wall shall be protected on sides and back of box with firestop putty pads as required to maintain integrity of rated wall.

3.03 INSTALLATION

A. Regulatory requirements: Install firestop products in accordance with fire rated test assemblies as published by either UL or Warnock Hersey or accordance with manufacturer engineer drawings.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration firestop systems.

1. Firestop all holes or voids made in fire resistive assemblies, made by penetrations, to ensure against the passage of flames, smoke, and toxic gases.
2. Protect materials from damage on surface subjected to traffic and install cover plate as required on any installed firestop system that will or may be subject to traffic.
3. Tool surfaces of firestop products to provide a smooth and clean appearance.

3.04 FIELD QUALITY CONTROL

A. Follow safety procedures recommended in Material Safety Data Sheets.

B. Examine penetration firestopped areas to ensure proper installation before concealing or enclosing areas.

C. Keep areas of work accessible until inspection by Architect.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving areas in undamaged and clean conditions.

B. Neatly cut and trim materials.

END OF SECTION

SECTION 260180 - INTRUSION ALARM SYSTEM

1.01 SUBMITTALS

A. Submit shop drawings consisting of:

1. Manufacturer's published literature.
2. One line schematic of complete system.

1.02 MANUFACTURERS

A. Intrusion Alarm System manufacturers shall be as follows:

1. Ademco
2. Radionics
3. DSC

B. The acceptable manufacturers systems listed in 1.02 A, shall be installed by the authorized local factory dealer/representative for that product. The factory dealer representative shall hold a current low voltage contractor's license.

1.03 GENERAL

A. Furnish and install a complete intrusion alarm system consisting of passive infrared detectors, arm defeat key switches, digital key pad, central monitoring and transmitting equipment.

B. All wiring shall be in raceway by intrusion alarm Sub Contractor and shall be as recommended by manufacturer furnishing equipment. All wiring shall be run in conduit; see one line diagram. The complete system shall be installed in accordance with manufacturer's specifications. Each intrusion alarm circuit shall be protected from lightning by installing surge protection units.

C. The alarm equipment shall be installed by a factory trained technician and placed in working order. The technician shall instruct operating personnel in the operation, adjustment and maintenance of the system.

D. Three sets of complete instruction for the operation, inspection, testing and maintenance of the system, including wiring diagrams and spare replacement part list shall be furnished before final acceptance of the system. Also, provide all special tools that are necessary for the maintenance of the equipment and include one set of fuses for each type and size.

E. Intrusion Alarm System Subcontractor shall submit a certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service within 12 normal working hours.

1.04 OPERATIONS

A. When the passive infrared detector notes an intrusion in shall cause an auto-dialer to transmit telephone calls to supervisory personnel. Also, the system shall energize the all-call switch on the building paging system and sound an alarm through all the building speakers. All components shall be double supervised for disarrangements. Arm defeat key shall permit authorized access to the building. Digital key pad shall be located at the central monitoring and transmitting equipment to arm or disarm the entire system.

1. Detector, Radial Pattern - Pulnix # PA 7100, surface ceiling mounted.
2. Detector, wide angle - Pulnix # PA7012, surface ceiling mounted.
3. Detector, long range - Pulnix # PA7030, surface ceiling mounted.
4. Control panel - Ademco Vista 50 with power supply, re-chargeable battery packs. Automatic dialer - two channel burglar and fire digital key pad.
5. Arm-defeat key switch to shunt zone in use. Chicago #407370C with RP-3 weatherproof plate.
6. Where detectors are located in an area susceptible to damage or in a Gymnasium, Contractor shall provide wireguards.

B. Control panel shall be equipped with a UL listed dialer for off premises central station monitoring. Low voltage contractor shall connect dialer to Telco line and include one (1) year of monitoring in contract.

1.05 CONDUIT AND OUTLETS

A. Conduit and its installation shall be as covered under Section 26020 of these specifications.

B. Outlets and their installations shall be covered under Section 26040 of these specifications.

C. Provide 3/4"C., from intrusion alarm control panel to telephone backboard.

END OF SECTION 260180

SECTION 260210 - DATA/VOICE NETWORK AND CABLING SYSTEM

1.01 SUBMITTALS

A. Shop drawings shall be submitted as follows:
1. Manufacturer's published literature for each separate type of equipment being provided. Indicate model number on cutsheet.
2. One line schematic of complete system showing a floor plan to scale. Show locations and the type of outlets, as well as all rack locations, and cabling type.
3. Documentation of testing on all wiring and terminations as per ANSI/TIA standards.

1.02 MANUFACTURERS

A. Acceptable manufacturers for each type of equipment specified shall be as noted throughout this specification section.
B. The acceptable manufacturers noted shall be installed by the authorized local factory dealer/representative for that product.
C. The contractor shall hold a current low voltage contractor's license and RCDD certificate. Any other interested parties shall submit a company resume showing years in business, certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours, list of key personnel, copies of appropriate licenses and list of recently completed jobs. Submittal must be received no later than ten business days prior to bid date in order to be considered.

1.03 GENERAL

A. Workmanship
All work shall be performed in a workmanlike manner. Architect, Engineer, and/or Owner may observe the work procedures and workmanship of the Contractor but such observation will not relieve the contractor from responsibility for performance.

B. Warranty
The Contractor shall furnish a written warranty that describes the equipment supplied under these specifications will be free from defects of materials and workmanship for a period of fifteen years from the date of final acceptance unless otherwise specified and that all defects occurring within that period shall be corrected in a timely manner at no cost to the Owner.

C. Contractor's Qualifications
Contractor shall be required, before awarding of contract, to demonstrate to the complete satisfaction of the Engineer that he has the necessary facilities, ability and financial resources to execute the work in a satisfactory manner and within the time specified; that he has had experience in construction work as same or similar nature; that he has past history and references which will assure the Owner of his qualifications for executing the work.

Contractor shall submit a copy of a valid low-voltage license (Low-Voltage General, Low-Voltage Telecommunications or Low-Voltage Unrestricted as issued by the State Construction Industry Licensing Board of Low-Voltage Contractors).

Contractor shall submit a copy of a BICSI (Building Industry Consulting Service International) certified RCDD (Registered Communications Distributions Designer) certificate.

D. Comprehensive list of references
Attach a detailed list of references along with contact person, dates of work, mailing address, telephone numbers.

E. Contractor must provide proof of installation in a minimum of five sites using a Enhanced Category 6 structured cabling with 100 or more active (working) nodes installed.

1.04 SCOPE OF WORK

A. Scope of Project Standards and Description

The cabling and wiring placed for voice and data communications on this undertaking shall be "Unshielded Twisted Pair" type and conform to the requirements contained in the latest editions of the National Electric Code (NEC) and the latest editions of the following American National Standards Institute (ANSI) specifications:

1. ANSI/TIA 568-Commercial Building Telecommunications Cabling Standard
2. TIA 569-Commercial Building Standard for Telecommunications Pathways and Spaces
3. ANSI/TIA/EIA 606-Administration Standard for Commercial Telecommunications Infrastructure
4. ANSI/J-STD 607-Commercial Building Grounding (earthing) and Bonding Requirements for Telecommunications
5. Addendums to TIA/EIA 568

B. Specifications for the Fiber Optic Backbone, the Network Hub Unit, Jacks Outlets, Horizontal Wiring, Patch Panel, and Racks are provided in this specification section.

1.05 GUARANTEES

A. All communication outlets wired and serviceable must be tested and certified in compliance with ANSI/TIA 568-C.2-1 Enhanced Category 6 specifications. Testing must be "end-to-end". Test results shall be forwarded to Engineer a minimum of one week prior to final inspection.

1.06 TESTING AND CERTIFICATION

A. Testing fiber optic and copper distribution systems are crucial in assuring the overall integrity and satisfactory performance of the network. Test results quantify system quality, identify system faults, and establish the baseline accountability performance of the system. Proper testing also maximizes the longevity of the system, minimizes downtime and maintenance, and facilitates system upgrades or reconfiguration.

B. The Contractor shall provide proof of communications wiring systems certification and testing certification.

C. All data and voice wiring and terminations shall be tested and must pass ANSI/TIA standards for Enhanced Category 6 Cabling. All faults shall be corrected.

D. All test results must be printed and show the following primary results:

1. Wire map
2. Length
3. Insertion Loss
4. Near-end crosstalk (NEXT)
5. Power sum near end crosstalk (PSNEXT)
6. Equal-level far-end crosstalk (ELFEXT)
7. Power sum equal-level far-end crosstalk (PSELFEXT)
8. Return Loss
9. Propagation delay

1.07 FIBER OPTIC BACKBONE

1.08 UNINTERRUPTIBLE POWER SUPPLY FOR NETWORK ELECTRONICS

A. The network electronics at each rack shall be plugged into an uninterruptible power supply which operates in a hot standby state when the AC power is present, providing power of consistent quality. Also, the switch over time must not be more than 3.5 microseconds. UPS shall be rack mounted and be a minimum of 2200 VA capacity, 120 volt input. UPS shall have network management capability and be manufactured by APC, Dell or Tripplite and OCC.

1.09 LOCAL AREA NETWORK (LAN) JACK AND OUTLET SPECIFICATIONS

A. Locations shown on drawings will be equipped with a consistent arrangement of LAN communications outlets.

B. Outlet faceplate for this arrangement shall be configured in the following fashion:

1. The jacks used shall fit properly in the outlet openings of the outlet faceplate. The jacks used shall conform to Enhanced Category 6 parameters of ANSI/TIA 568-C.2-1

a. In a properly installed Category 6 UTP cabling system, the jacks used shall be capable of supporting LAN data rates of 1000 Mbps.
b. The wiring arrangement of the jack shall conform to the ANSI/TIA 568.
c. The jack shall possess the following characteristics:

1. The eight (8) position / eight (8) conductor jack shall be capable of supporting the previously defined data rates as well as voice (including ISDN).
2. Utilization of 110 type or equivalent insulation displacement hardware for horizontal wire attachment and acceptance of 22 or 23 AWG conductors.
3. The jack wires shall consist of 50 micro-inch lubricated gold plating over 100 micro-inch nickel underplating.

d. Any vacant faceplate position shall be reserved for future growth and should have a dust cover/blank inserted.

C. Acceptable Manufacturer's: Molex, Ortronics, Commscope, AMP, and Belden, Leviton, Panduit, Siemon, and OCC.

D. Each jack shall have faceplate labeled. Also neatly label backside of faceplate with a permanent marker to note jack number.

E. Labeling of multiple drops in a common space shall be sequentially numbered. Numbers shall not be assigned randomly. Coordinate prior to terminating at racks, no exceptions.

1.10 LOCAL AREA NETWORK (LAN) HORIZONTAL WIRING SPECIFICATIONS

A. This section covers the cable from the communications outlet to the patch panel in the IC or wiring closet. These cables shall be Enhanced Category 6 Unshielded Twisted Pair cable. Each cable shall be placed in a "point-to-point" fashion from the work area outlet to the wiring closet for each communications outlet needed. There shall be no intermediate splices or cross connects in these cables.

B. The characteristics of the horizontal cable are as follows:
1. Enhanced Category 6 cable consisting of four pair of 23 AWG bare solid copper conductors insulated with a plenum rated material. The insulated conductors are tightly twisted into pairs and jacketed with plenum rated material. No type of shield is required in the sheath.
2. Each sheath shall contain four unshielded copper pairs. Each pair shall have a different twist per foot ratio ranging from 12 to 24 twists per foot. No more than 1/2" inch may be untwisted and the sheath may not be stripped back more than 1/2" inch at the jack during installation.

C. The cable component shall meet or exceed the following requirements:
1. ASNI/TIA 568-C.2 "Commercial Building Telecommunications Standard, Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard”
2. ASNI/TIA 1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted Pair Cabling ”
3. Certified Category 6 Cable under Third Party Cable Certification Program.
4. ICEA S-102-700
5. ANSI/ICEA S-102-732
6. UL Standard 444
7. National Electric Code - Article 800

D. Subject to compliance with specification requirements, the only acceptable Enhanced Cat. 6E cables approved for use as follows:

1. Mohawk Advancenet
2. Commscope Ultramedia 7504
3. Belden Datatwist 4800
4. Central Cable Genspeed 6000
5. Berk-Tek Lanmark 1000

E. Plenum rated cable shall be used. The plenum cable shall be composed of four pair of 23 gauge bare solid copper conductors insulated with a plenum rated insulation that is the same material configuration on all four pairs, 3+1 or 2+2 designs are not allowed. The

insulated conductors are tightly twisted into pairs and jacketed with low smoke plenum rated PVC. It shall conform to a NEC Type CMP for plenum and NEC Type CMR for riser applications.

1.11 LOCAL AREA NETWORK (LAN) PATCH PANEL SPECIFICATIONS

A. This section covers the termination hardware located in the MC and IC (wiring closet). The termination hardware shall provide the capability to be able to patch connections between ports on the LAN hardware (electronics) and the horizontal cables to the work area outlets.

B. The Patch panels shall be Category 6 Modular Jack Panels. Provide 24 port or 48 port patch panels as required for number of drops.

C. The termination hardware will be co-located on 19" inch racks with the LAN electronics. The configuration of the patch panels shall be in an agreement that minimizes patch cord lengths. Provisions for cable management (organization of horizontal and vertical cable and patch cords) on the rack should be included.

D. Horizontal cables to the work area outlets will be directly connected to 110 insulation displacement hardware or equivalent associated with each jack on the patch panel. The jacks on the patch panel shall be wired in accordance with ANSI/TIA 568- C.2 standard.

E. Enhanced Category 6, factory-built, manufacture tested patch cords shall be provided for each drop. Provide 10' patch cord at station end. For Computer Labs, provide 15’ or 25’ station cable patch cords. Provide 3' or 5' patch cord at rack end. (Length as required for electronics to properly lace cords). Patch cords shall be color coded for dedicated labs, media center, etc. Provide velcro patch cord wraps for cable management.

F. Fiber Termination requirements:

Fiber optics connections should be terminated using a rack mountable Interconnect enclosure or equivalent to insure that the connections are protected. The enclosure should be locked and no fiber cable should be visible in the rack.

G. Acceptable Manufacturer's: Molex, Pass & Seymour, AT&T, AMP, Hubbell, Leviton, Panduit, Siemon, and OCC.

1.12 LOCAL AREA NETWORK (LAN) RACK SPECIFICATIONS

A. The rack shall be EIA 19” open equipment rack, 84” high, aluminum construction, drilled and tapped on both sides to EIA Standard. Rack shall have top and bottom angles for support, 15 inch wide foot with holes for bolting to floor, and factory installed grounding lugs. Black powder coated. Rack shall have two (2) position ring runs and rear cable management tray as required per number of patch panels. Provide cable management rings on sides of rack.

1.13 SYSTEM DOCUMENTATION

A. As part of the wiring system installation, the Contractor shall provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings with all cables and terminations identified, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support

equipment, and model and serial numbers of all installed equipment. A clear and consistent nomenclature scheme is to be defined and used on the documentation and cable labeling which facilitates locating and identifying each cable.

B. System verification and acceptance documentation signed and dated by the installer (Contractor) and the design professional shall also be provided. This documentation shall include test measurements and system calibrations performed for the entire system. Sample system operations shall also be performed with actual hardware or using contractor provided test equipment and documented to verify that the system is operational and ready for acceptance. This shall also establish the baseline performance of the system.

1.14 TRAINING

A. Training of owner's personnel (a minimum of two) shall be provided. Training will cover the location nomenclature, documentation structure and contents, documentation maintenance procedures, a "walk-through" for location and labeling orientation, system reconfiguration using the MDF, and IDF facilities (Termination hardware, punch blocks, etc.), operation of network equipment installed as part of the contact, test documentation, and trouble shooting of the signal and power cable portion of the installation.

B. Provide a record set plan noting drop locations and jack designations. As-built shall be a full size plan and shall be computer generated in AutoCAD 2007 format. Provide a CD to Owner with (as-build) on disc at project closeout. At each rack provide a copy of (as-built) mounted on wall. Mount plan under plexiglass.

END OF SECTION 260210

SECTION 26 0230 - CONSTRUCTION REVIEWS INSPECTION AND TESTING

1.01 GENERAL

A. Comply with Division 1 - General Requirements.

1.02 CONSTRUCTION REVIEWS

A. The Architect or his representative shall observe and review the installation of all electrical systems shown on the drawings and as specified herein.

B. Before covering or concealing any conduit below grade or slab, in wall or above ceiling, the contractor shall notify the Architect so that he can review the installation.

1.03 CONTRACTOR'S FINAL INSPECTION

A. At the time of the Contractor's final inspection, all systems shall be checked and tested for proper installation and operation by the Contractor in the presence of the Architect or his representative.

B. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.

C. Following is a list of items that the contractor must demonstrate to the Architect or his representative as complying with the plans and specifications. Please note that this list does not necessarily represent all items to be covered in the final inspection, but should give the Contractor an idea of what is to be reviewed.

1. Service ground, show connection to ground rod and cold water main.

2. Demonstrate that main service equipment is properly bonded.

3. Demonstrate that all panels have breakers as specified, ground bar, copper bus, typed directory for circuit identification and that they are free of trash.

4. Demonstrate that all conduits are supported as required by the National Electrical Code.

5. Demonstrate that all outlet boxes above or on the ceiling are supported as required by the National Electrical Code.

6. Demonstrate that outlet boxes in wall or ceilings of combustible materials are flush with surface of wall or ceiling, and that outlet boxes in walls or ceilings of non-combustible materials are so installed that the front edge of the box or plaster ring is not set back more than 1/4".

7. Demonstrate that outlet boxes in wall are secure.

8. Demonstrate that all devices are properly secured to boxes, that device plates are properly aligned and are not being used to secure device.

9. Utilizing a Woodhead No. 1750 testing device, demonstrate that all 125 volt receptacles are properly connected.

10. Demonstrate that all fixtures have specified lamps, ballast and lens, and that they are supported as required by the National Electrical Code or as called for on the drawings or in the specifications.

11. Demonstrate that all disconnects requiring fuses are fused with the proper size and type, and that all disconnects are properly identified.

12. Demonstrate that Fire Alarm System is in proper working order, initiating an alarm signal from each manual and automatic device (including smoke detectors).

END OF SECTION

SECTION 274116 – INTEGRATED AUDIO-VIDEO COMMUNICATIONS

PART 1 - GENERAL

1.1 GENERAL

A. This specification outlines Presentation Systems Contractor (PSC) requirements to furnish and install presentation systems and all low voltage wiring required for completely operational systems in the Strickland Cultural Arts Center project. All necessary infrastructure shall be required and provided by the PSC for a completely operational audio-visual presentation system inclusive of sound, video, AV control, lighting equipment, lighting controls, stage draperies and stage rigging. A separate bid for all work required in conjunction with the stated A/V package for a complete and functioning electrical packing will be required.

B. The systems shall not be considered complete until the completion of as-built documentation, final system commissioning, and facility personnel training. This facet of the services to be provided by the PSC is deemed very important to the satisfactory completion of the contract. To that end a final payment reserve of 10% of the system purchase price shall be held from payment until the documentation package and training described in Part III are delivered.

1.2 RELATED SECTIONS

A. Architectural
B. Electrical
C. Fire Protection
D. Mechanical

1.3 INTENT AND INTERPRETATIONS

A. It is the intent of the Construction Documents that the PSC shall include all items necessary for the proper execution and completion of the project, resulting in complete and fully operational system(s) ready for the Owner’s use, in full compliance with all applicable standards, codes and ordinances.

1. Work or product not specifically indicated in the Construction Documents, but which are necessary to result in complete and fully operational system(s) ready for the Owner’s use, shall be provided by the PSC.

2. The specification of certain products in the Construction Documents shall not be construed as a release from furnishing such additional products and materials necessary to furnish complete and fully operational system(s) ready for the Owner’s use.

B. In the event that discrepancies exist or required items or details have been omitted in the Construction Documents, the PSC shall notify the Owner/Consultant in writing ten (10) days prior to the bid date. Failure to do so shall be construed as willingness to provide a complete and fully operational system within the amount bid by the PSC. Where such discrepancies are not brought to the attention of the Owner/Consultant, the most stringent (costly) requirements shall be construed to be the basis for the PSC's bid.

C. Drawings and Specifications are complementary. Items required by either are binding as though they are required by both. In the event of conflict between the requirements of the Drawings and the Specifications:
   1. With regards to the preparation of proposals and/or bids, the PSC shall assume the more stringent (costly) condition shall prevail. The PSC shall notify the Owner/Consultant of such a minimum ten (10) days prior to the bid date.
   2. With regards to actual construction, the PSC shall notify the Owner/Consultant and await the Owner's/Consultant's instruction prior to proceeding with procurement and installation.

D. Drawings:
   1. Drawings are diagrammatic and approximate in character, are not intended to show all features of required work, and do not necessarily indicate every required component.
   2. Symbols used on the Drawings are defined in the legend on the Drawings. Symbols indicated on the legend may not necessarily be required.

1.4 DEFINITIONS

A. The term "Contractor", "Supplier", or "Presentation Systems Contractor (PSC)" as used herein refers to the party responsible for supplying all services and equipment covered herein and on related drawings.
B. The term "Consultant" shall refer to the consultant who is responsible for the design of the audio, video, and control systems.
C. The term "Electrical Contractor" shall refer to the Division 26 contractor.
D. The term "provide" will mean to supply, install, verify performance, and coordinate interconnection and power.
E. Specialized terms particular to technical systems and related work shall be used in the following manner, in accordance with:
   1. Captions on related drawings.
   2. Generally recognized audio engineering and production usage.
   3. Relevant usage and definitions of handbooks, guidebooks or trade group recommendations by manufacturers' associations or professional and engineering societies such as SMPTE, ICIA, UL, and NEMA.

1.5 RELATED DOCUMENTS

A. The PSC shall read, review, and understand all documents listed below prior to bidding or proceeding with work. The PSC shall also refer to and understand all other related documents indicated herein. Failure to familiarize itself with the construction documents will not relieve the PSC of its responsibility to complete the work in accordance with the construction documents.
B. Division 1: Applicable provisions of Division 1 shall govern all work under this section.
C. Contract: In addition to the conditions and work described herein, all conditions of the Contract shall apply.

D. Presentation System Drawings:

1. AV001 LEGEND
2. AV101 AUDITORIUM 1ST FLOOR PLAN
3. AV102 AUDITORIUM 2ND FLOOR PLAN
4. AV201 AUDITORIUM AV REFLECTED CEILING PLAN
5. AV202 AUDITORIUM LIGHTING REFLECTED CEILING PLAN
6. AV203 AUDITORIUM STAGE LAYOUT
7. AV301 AUDITORIUM SECTION
8. AV401 PLATE DETAILS
9. AV402 PLATE DETAILS (CONT.)
10. AV403 AUDIO DETAILS
11. AV404 VIDEO DETAILS
12. AV405 LIGHTING DETAILS
13. AV406 EQUIPMENT RACK DETAILS
14. AV701 AUDIO INPUT FLOW DIAGRAM
15. AV702 AUDIO OUTPUT FLOW DIAGRAM
16. AV703 VIDEO AND INTERCOM FLOW DIAGRAMS
17. AV704 LIGHTING FLOW DIAGRAM

1.6 DESCRIPTION OF SYSTEM

A. AUDITORIUM AUDIO

1. The auditorium shall be equipped to support productions of all sizes with high-quality amplification of speech, performance instruments of all types, and program content playback. There will be 1 primary operational modes of the sound system, *Production Mode.* In this mode, primarily for theatrical productions or band / concert performances, the operator will have constant hands-on manual control of the mix and levels.
2. In the event there is a fire alarm instance, the sound system shall mute. Coordination with the fire alarm contractor is key to obtain a contact closure or other signal to engage the audio system accordingly.
3. The main mixing console shall have a minimum of 48 mono and 2 stereo input channels for mixing.

4. Production - There shall be 7 channels of wireless microphones channels.

5. The loudspeaker configuration shall consist of main loudspeakers, delay fill loudspeakers, and subwoofers. Programmed settings such as equalization, limiting, and delay in the DSP shall be done in a way as to keep the final room tuning settings away from normal operation and operators and shall be password protected.

   There shall be audio inputs and outputs available on stage. There will be floor boxes down stage as detailed on the drawings. There shall be 2 discreet monitor mix feeds for floor wedges, side fills, or passive hotspots. Distribute the monitor mix outputs to I/O plates around the stage and floor boxes according to drawings.

6. There shall be a RF based assisted listening system. The appropriate number of receivers shall be included in accordance with ADA regulations. Receivers shall have the ability to transmit audio through a T-coil lanyard for hearing aids and conventional earphones as well.

7. A 2-channel production intercom system shall provide comfortable, intelligible communication between the various technical locations, and stage manager. The main station will be in the stage manager's equipment rack. In addition to these locations of intercom, there shall be intercom drops located at various locations on stage and spotlight positions.

B. AUDITORIUM VIDEO

1. The auditorium shall be equipped to support productions with high-definition imaging of computer and media playback sources.

2. The auditorium shall have a large rear screen projector system for the viewing of presentations. The screen shall be electric and mounted downstage from a dead hung batten as per the drawings. The PSC shall verify the amount of black drop needed before ordering the screen.

3. The projector shall be mounted on the upstage wall and project to a rear screen. The projector shall be a laser light engine for best contrast and brightness.

4. The aspect ratio of the screen and projected image shall be 16:10

5. There shall be a presentation switcher/matrix mounted in the equipment rack at the stage manager's position.

C. AUDITORIUM CONTROL SYSTEM

1. The remote-control system shall provide integration and control of key components using wired touch panels. Programming shall focus on operation of the presentation system ranging from simple podium events to manual operated productions. Menu shall include, but not limited to the following.
   1) Production Mode
   2) Lighting pre-set recall
      a. Contractor to provide 4 lighting presets per the owner's guidance.
   3) System power cycle screen

a. All AV
b. Projector power
c. Screen control

4) A/V switcher screen
   a. Source selection
      i. Stage Laptop
      ii. Booth Sources
      iii. Stage Video
      iv. Stage audio (MP3/CD)
   b. Source audio volume in presentation mode
5) Media player commands
   a. Blu-ray transport commands and menu functions for each player

D. AUDITORIUM LIGHTING

1. The auditorium shall be equipped with a production lighting system to support theatrical productions.
2. The lighting console shall be used to control the theatrical lights in the auditorium and stage area.
3. There shall be 1 manually operated spotlights included in the lighting package.
4. All theatrical fixtures shall be LED and be supplied complete with safety cable, c-clamp, lenses, DMX/power cables and extension cables as needed.
5. The lighting battens shall contain LED lighting fixtures and power for these to be controlled through relay modules in the dimmer racks. DMX control for the operation of each lighting fixture.
6. The Contractor is responsible for programming the following production scenes for initial commissioning.
   1) Full stage wash
   2) Podium or Presentation Event
   3) (2 ea.) Owner specified settings on the console

E. AUDITORIUM CURTAINS

1. Main Curtain material to be 25oz. Charisma unless specified differently.
2. Mid Stage and Rear Stage panel shall be Athena Black
3. Curtain material shall be NFPA 701 – Class A compliant.
4. The curtains shall be 50% fullness.
5. Curtains shall consist of:
   a. Grand Valance

b. Grand Drape

c. Legs- 1 set

d. Mid-stage traveler

e. Borders-1 border

f. Rear Traveler

g. Cyc – 1 curtain – Walk along

F. AUDITORIUM RIGGING

1. All rigging and rigging hardware above the stage area shall be black or painted black.
2. All pipe, couplers, and rigging hardware for the lighting grid shall be black or painted black.
3. All rigging shall be installed with a 5 times safety factor
4. The FOH rigging shall be 1 ½" schedule 40 pipe batten, dead hung with ¼" proof coil chain, and shackles.
5. The overstage rigging shall be 1 ½" schedule 40 pipe batten, dead hung with ¼" proof coil chain, and shackles.

1.7 SCOPE OF WORK

A. Work Included

1. Provide all labor and material for the complete installation of the presentation systems as hereafter specified and shown.

2. PSC shall review the entire project package, including drawings and notes for other trades that may impact the Presentation Systems work, and make provision for such.

3. Equipment shall be new, current production, with original warranty. Demo, refurbished, used or B-stock equipment shall not be acceptable.

4. Quantities are listed for reference only. It is the PSC responsibility to verify quantities of all components.

5. All equipment must be installed in a neat and orderly fashion by competent workmen according to the manufacturer's instructions.

6. All system components shall be completely prewired with all field connections clearly labeled. All equipment shall be UL and or CE listed and shall comply with the National Electrical Code or equivalent authority and all applicable regulations of serving utilities and governmental bodies having jurisdiction.

7. Presentation equipment shall not be stored at the job site. Equipment shall be moved to the job site from a conditioned space only when scheduled for installation.

B. Work Specified Elsewhere

1. Installation of raceways, pull-boxes, floor boxes, and conduit (provided under electrical work).

2. Installation and termination of house network systems.

3. Cutting, patching, and painting walls, unless damaged performing the work described within.

C. Coordinated Work

1. Coordinate with related trades to schedule the work and ensure a complete installation in accordance with the schedule outlined by the owner.

1.8 CONTRACTOR'S QUALIFICATIONS

A. General

1. The PSC shall be a company that regularly engages in the furnishing and installation of systems similar in complexity to those required for this project and in this section and must meet the following requirements in each discipline listed here to include Audio, Video/Control, Lighting, and Rigging.

2. A subcontractor so employed as the "Presentation Systems Contractor" must be accepted and/or pre-approved by virtue of their standing and agreements with all equipment manufacturers to be installed and commissioned in this section. The PSC must be acceptable to the Architect and the Consultant and shall be identified on the Bid Proposal Form.

3. The primary business of the PSC shall be the sale and installation of professional performance-related sound, video, control, lighting, and rigging systems.
4. The PSC shall have no less than five years of experience with equipment and systems of the specified types of systems that follow.
5. Proof of successful completion with present key staff, of five projects of the type or magnitude of that specified here in this project.
6. Regular business under the same name and/or address for a period of five years.
7. Have technicians trained in the specific installation and maintenance of the equipment supplied.
8. Have suitable service facilities and test equipment for providing competent service for all types of professional dimming, rigging, sound, video, and control system equipment.
9. Maintain shop and office facilities within a 125-mile radius of the project site.
10. Employ a minimum of 1 full-time engineer with AVIXA Certified Technology Specialist - Design (CTS-D) certification.
11. Employ a minimum of 1 full-time installer with AVIXA Certified Technology Specialist - Installation (CTS-I) certification.
12. At the request of the Owner, the PSC shall demonstrate to the satisfaction of the Architect and Consultant that the PSC has:
    a. Adequate facilities and equipment to complete the work.
    b. Adequate staff with commensurate technical experience.
    c. Suitable financial status to meet the obligations of the work.

B. Audio
1. Personnel engaged in the audio portion of this project shall have the following certifications
    a. Biamp, Q-Sys, & BSS Audio senior-level programming
    b. Dante Level 3 Master Certification
    c. AVIXA Certified Technology Specialist - Design (CTS-D)
    d. AVIXA Certified Technology Specialist - Installation (CTS-I)
    e. EASE Training
    f. Syn-Aud-Con certification
2. Employ a qualified "sound system and A/V production expert" with sufficient experience in production to providing training and assistance to the Owner during the initial system use period.

C. Video / Control
   1. Personnel engaged in the video portion of this project shall have the following certifications
      a. Crestron Master Programmer
      b. Crestron Digital Media Engineer
      c. Extron AV Associate certification
   2. Employ a minimum of 1 full-time programmer that is a Crestron Certified Programmer.

D. Lighting
   1. The PSC shall be pre-approved as an ETC lighting provider for all stage lighting fixtures, stage/house dimming and dimming controls with various interfaces.
   2. Lighting system equipment in this section shall be provided, installed, and commissioned by a pre-approved ETC dealer.
   3. If the system design requires, the PSC shall be responsible for the convergence of the house and theatrical lighting system with the AV remote control system. This will enable lighting presets to be recalled from the AV control system.

E. Rigging
   1. The General Contractor shall provide and install structural steel to support the following;
      a. All main and delay loudspeaker hanging locations. Typical load of 500-750 lbs.
      b. All hoist and lighting batten locations. Loads vary
      c. All dead hung batten locations. Loads vary
   2. The PSC shall employ only fully trained permanent stage riggers and mechanics who can be assisted by common laborers, for the erection and installation of the stage rigging equipment. The riggers shall be completely familiar with the types of equipment being installed.
   3. A competent Job Supervisor shall be on the job site at all times while work is in progress. The Job Supervisor of rigging shall represent the PSC and all directions given by him/her shall be as binding as if given by the PSC directly. The PSC shall have on site an installer with the rigging manufacturer certification.

F. Subcontracting
   1. Any other Contractor/Supplier who intends to bid this work as the prime Contractor/Supplier and does not meet the required qualifications shall employ the services of a single "Presentation Systems Contractor" who does meet the requirements noted above and is approved by the Owner, Architect and Consultant as well. This "Presentation Systems Contractor" shall:
      a. Furnish the equipment.
      b. Meet all qualifications stated earlier in this section.

c. Shop fabricates the equipment racks and subassemblies.

d. Make all audio, video and control connections to equipment racks, each piece of equipment, and connection panels.

e. Continuously supervise the installation and connections of cable and equipment.

f. Program the digital signal processor, video processing systems and control system.

1.9 BID SUBMITTALS

A. Along with the bid price, the PSC shall include the following:

1. Equipment list noting equipment quantities, manufacturer, brief description and specification number.

2. Statement that the bid is based on specified products.

3. Address of staffed office within 125 miles of the job site.

4. Statement that the Contractor has an established toll-free hot-line and will provide 24-hour/7-day-a-week phone support and on-site emergency service as necessary to correct technical failures.

5. List of five installations completed within the last three years, which are similar in size, type and scope to the work specified in this Section. Include project name, date of installation, name of contact and phone number.

1.10 PROJECT SUBMITTALS

A. Upon award of the contract, PSC shall provide:

1. Preliminary project schedule with timeline, skills and labor requirements.

2. Name and qualifications of PSC personnel who shall be supervising the installation of the system. This person shall be a full-time employee of the PSC. The PSC shall submit electronic documents of the following for review by the Architect and the Consultant. Refer to the General and Special Conditions for additional set(s) which may be required. All documents shall be submitted prior to ordering any materials.

3. A complete list of all equipment and materials which are to be furnished. Accompanying the list shall be manufacturers' specification or cut sheets for all equipment.

4. Shop drawings generated by the Contractor. The Contractor shall be provided with electronic copies of the floor plans, device layouts and room sections only for use in preparing their shop drawings. The Contractor is responsible for editing these sheets as required by these submittal requirements. The Contractor is required to generate all other sheets as required by these submittal requirements.

a. Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and wire numbers, and device designators.

b. Plan view showing locations of all equipment. Plan(s) shall be properly dimensioned, and all equipment labeled.

c. Wall elevations and room sections showing all installed equipment. Elevations and sections shall be properly dimensioned, and all equipment labeled.

d. Equipment rack layout details, including power, grounding, ventilation and conduit/cable entry as applicable.

e. Loudspeaker system suspension schematic including hardware types and load capacity.

f. Complete drawings of custom-fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.

g. Power requirements, one-line riser diagrams, and installation circuit diagrams for electrical equipment. Show all required wire sizes and counts between all components.

h. Manufacturer's detailed shop drawings of all dimming, control and distribution equipment, and published literature for all equipment.

1.11 WARRANTY

A. All equipment is to be new and warranted free of faulty workmanship and damage.

B. The total system (parts and labor) is to be warranted free of defects for a period of one year from date of final acceptance.

C. The entire system (excluding lamps and fuses) shall be fully factory tested prior to shipment and shall be guaranteed against defects in material and workmanship for one year from date of acceptance by the Owner or (12) eighteen months from the date of shipment, whichever occurs first.

D. No equipment having a shorter warranty shall be considered and equipment purchased shall be covered by this warranty. Unspecified length of warranties shall not be acceptable.

E. Contractor shall provide for replacement of defective materials and repair of faulty workmanship within (48) forty-eight hours of notification by owner guaranteed at no cost to the owner during the warranty period.

F. Contractor shall provide emergency service and support 24 hours a day and 7 days a week. This service is intended as emergency response to failures that require immediate help from a qualified systems technician. The Contractor shall provide this service through an established toll-free line. This emergency service must include a return call from a qualified systems technician within 2 hours. This emergency service must also provide an on-site visit from a qualified systems technician within 12 hours of the initial phone call, should it be deemed necessary by both parties to resolve the service issue. This emergency service and support shall be made available throughout the warranty period at no additional charge to the owner.

G. Paint and exterior finishes, fuses and lamps are excluded from the above warranties except when damage or failure results from defective materials or workmanship covered by warranty.

H. The minimum warranty provisions specified above shall not diminish the terms of individual equipment manufacturer warranties.

1.12 INSTRUCTION OF OWNER PERSONNEL

A. PSC is to provide at least 8 hours (1 each four hour sessions) of training to person(s) selected by the Owner on operation and basic maintenance of all systems and equipment. In addition to training, a representative of the Contractor knowledgeable of the system installation and operation is to be present for the first special events selected by the Owner that all or any part of the sound and video systems is used. The training and event attendance is to take place during the 30-day period after system completion.

PART 2 - PRODUCTS

2.0 GENERAL

A. It is the intention of these specifications to provide a complete and properly operating system. The major items of equipment shall be furnished in the quantity indicated by the project drawings or in the quantity specified herein. In the event of a quantity discrepancy between the drawings and specifications for an item, the PSC shall provide the greater. PSC is responsible for providing all accessories and miscellaneous equipment required to form a complete and operational system, including, but not limited to, power supplies, cabling, mounts, attachment hardware and software licenses.

B. Provide only new products, and include the manufacturer's original factory warranty, product documentation and the latest version of any software required for configuration and/or operation.

C. The Manufacturer / Models listed in Part 2 - Products section, are representative of the equipment’s capabilities and specifications that was used to determine the overall design of the various systems. If a PSC bidder chooses to bid a different manufacturer / model than what is listed, it is their responsibility to ensure the equipment that is bid is equal to, or better than the equipment listed in these specifications.

D. Where the specifications list several manufacturers for a particular major item of equipment, such as power amplifiers, the PSC shall supply all of that item of equipment from one manufacturer.

2.1 PRODUCTS

A. DIGITAL AUDIO MIXER

1. 24 mono mic inputs
2. 8-line inputs
3. 80 channels to mix
4. DMX interface and control -control sound and light
5. 4 Stereo Lexicon Effects engines
6. Acceptable manufacturer/model, or better than:
    a. Soundcraft Si Performer 2

B. DIGITAL MIXER STAGE BOXES

1. The 16 Remote Controlled Mic Preamps
2. 8 Line-Level Outputs
3. 1 MADI over RJ45/Cat5 Connectors
4. Maximum Distance 328'/100m
5. The stage box shall be a 2RU rack mountable device

6. Acceptable manufacturer/model, or better than:
    a. Soundcraft Mini Stagebox 16i

C. AUDIO SPEAKERS – MAIN LOUDSPEAKERS
1. Main loudspeakers are to be two-way full-range
2. Power handling – 400W program
3. 1-12” LF Speaker and 1-3” VC HF driver
4. 90˚ H x 50˚ V with rotatable constant directivity horn
5. 10mm hanging points
6. Provide all brackets, hardware, and rigging components to mount per drawings
7. Acceptable manufacturer/model, or better than:
    a. JBL AM5212/95

D. AUDIO SPEAKERS – MAIN FOH SUBWOOFERS
1. Power handling – 800W program
2. 1-15” woofer and 1-3” voice coil
3. 16 points (4 top, 4 bottom, 4 each side), M10 threaded hardware
4. Provide all brackets, hardware, and rigging components to mount per drawings
5. Freq range of 32hz – 1khz
6. Acceptable manufacturer/model, or better than:
    a. JBL Pro ASB6115 (Confirm finish prior to ordering)

E. AUDIO SPEAKERS – STAGE WEDGE MONITORS
1. Speakers to be passive 2-way type
2. Power handling – 600W program
3. 1-12” LF Speaker and 1-1” VC HF drivers
4. 90˚ H x 50˚ V with rotatable constant directivity horn
5. Acceptable manufacturer/model, or better than:
    a. JBL JRX212M, black (Confirm finish prior to ordering)

F. AUDIO POWER AMPLIFIERS – MAIN, DELAY, SUBWOOFERS, & MONITORS
1. Two-channel in a 2RU chassis
2. 425W/ch at 8 Ohms, 700/ch at 4 Ohms

3. XLR & euro-style input connectors and barrier strip output terminals
4. Shall have no greater than 1% THD at 1Khz at maximum power
5. Acceptable manufacturer/model, or better than:
    a. Crown CDi4x300
    b. Crown CDi4x600
    c. Crown CDi2X600

G. NETWORK SWITCH - DANTE
1. The switch shall have 16 ports minimum
2. The switch shall be an unmanaged switch
3. The switch shall be at least 1Gb speed
4. All ports support PoE
5. Acceptable manufacturer/model, or better than:
    a. Cisco CBS-350-16FP-4G

H. AUDIO DIGITAL SIGNAL PROCESSOR (DSP)
1. DSP shall meet the following minimum criteria
    a. 128 x 128 network audio channels
    b. 8 analog input x 8 output x 8 flex channels
    c. Expandable to 32 x 32 with licensing
    d. 1RU rack mount
    e. Supports standard DSP functions such as auto-mixing, routing, parametric EQ, Hi-Lo band pass, muting, etc.
2. Acceptable manufacturer/model, or better than:
    a. QSC Q-Sys Core 110f w/ scripting, UCI, and Dante licensing as required

I. AUDIO MICROPHONES WIRELESS PERFORMANCE
1. The wireless microphones shall have the added capability of 64Mhz bandwidth of digital tuning
2. There shall be 24-bit/48kHz digital audio
3. Over 120db of dynamic range
4. The receiver shall contain 1 wireless channel
5. Handheld and lavalier belt pack transmitters for each receiver

6. Contractor to cable all receivers in drawings Owner to provide more transmitters in future (See Qty in Basis of Design Schedule)
7. Acceptable manufacturer/model, or better than:
    a. Sennheiser EW-D ME2/835-S

J. WIRELESS ANTENNAS / DISTRIBUTION
1. The distribution system shall be a wideband UHF designed for the frequencies of the wirelesses.
2. Provide antennas, antenna boosters and splitters per drawing
3. Provide all coax and any necessary power cables
4. Acceptable manufacturer/model, or better than:
    a. Sennheiser ASA 214

K. AUDIO MEDIA PLAYBACK
1. The audio player shall have a CD player and radio tuner
2. The player shall have a Bluetooth receiver to allow playback through the system from users phones, iPad, etc.
3. The player shall have an 1/8” Aux input jack
4. Audio player shall have stereo balanced and unbalanced analog outputs
5. The player shall be remote control via Infrared control
6. Acceptable manufacturer/model, or better than:
    a. Tascam CD-400U

L. ASSISTIVE LISTENING SYSTEM
1. ALS transmitter to be an RF based system
2. Antenna to be mounted in best location and proximity of audience
3. The number of channels to be 17 wide band, 40 narrow band
4. Provide 16 receivers, standard 3.5mm standard earphone, and lanyard devices per BOD Schedule 1
5. Apply ALS System Available placard as instructed by ADA requirements
6. Acceptable manufacturer/model, or better than:
    a. Listen Technologies
    b. Williams

M. INTERCOM-MASTER STATION

1. The production intercom system shall be the analog party line solution
2. The system master station shall be a 2-channel system
3. The master station shall be able to power up to 55 single-channel belt packs or 10 speaker stations or 12 headset stations distributed over both channels
4. The master station shall accept a line-level program input
5. See associated schematic drawing to identify the type of user stations and locations
6. Provide lightweight single muff headset for this station
7. Acceptable manufacturer/model, or better than:
    a. Clearcom MS-702

N. INTERCOM-WIRED BELTPACK
1. Headset connections shall be a 4 pin XLR.
2. The belt pack shall be a 1-channel belt pack
3. Provide lightweight single muff 4 pin headsets with all belt packs.
4. Acceptable manufacturer/model, or better than:
    a. Clear-Com RS-701

O. INTERCOM-HEADSETS
1. The headset shall be a lightweight single muff.
2. The headset shall come with a 4 pin female XLR
3. 300-degrees boom mic rotation for ON/OFF mic-mute switch
4. Acceptable manufacturer/model, or better than:
    a. Clear-Com CC-300

P. STAGE CURTAINS
1. Curtain material shall be classified as NFPA 701, 260A, - Class A flame resistant compliant for areas of assembly
2. Stage Curtain dimensions are prone to change. Field verify all lengths prior to ordering.
3. Stage Curtains shall consist of:
    a. Grand Valance
    b. Front Grand Drape
    c. Pleated Legs

d. Borders

e. Mid Stage Traveler

f. Rear Stage Traveler

g. Cyclorama on track

4. Main curtain & valance fabric to be 25 oz. IFR Charisma fabric unless noted otherwise on Schedule 1

5. Curtains shall be 50% fullness

6. Include all hardware and track necessary to hang curtains

7. Acceptable manufacturer/model, or better than:

a. Charisma (Fabric)

b. Rose Brand (Mfg.)

Q. VIDEO PROJECTOR – MAIN PRESENTATION

1. The projector shall meet the following specifications.

a. Native resolution: WUXGA, 1920x1200

b. 3-chip DLP

c. Solid-state laser light source

d. Brightness: 8,500 Lumens

e. Provide correct lens for throw distance. Verify model number

2. Acceptable manufacturer/model, or better than:

a. Epson EB-PU1008B

R. MOTORIZED PROJECTION SCREEN

1. The screens shall meet the following specifications.

a. The aspect ratio is to be 16:10

b. 260” W x 162” H; 278” diagonal viewing area

c. Screen shall be an electric with external LV interface included

d. Tab-tensioned rear projection material with 60” black drop

2. Acceptable manufacturer/model, or better than:

a. Draper Paragon V Series

S. PROJECTOR MOUNTS – WALL & SUSPENDED

1. The main projector mount shall be wall mounted to the upstage wall.
2. Supply necessary column pipes, structural adapters, and projector mounting adapter plates per drawing details
3. Acceptable manufacturer/model, or better than:
    a. Chief (Milestone)

T. VIDEO TRANSMITTER – STAGE RACK
1. The transmitter shall be HDBaseT compliant
2. The transmitter shall have 1 - 4K HDMI input
3. A single CAT type cable shall connect the unit to a receiver or HDBaseT device
4. Acceptable manufacturer/model, or better than:
    a. Extron DTP HDMI 4K 230 Tx

U. VIDEO SWITCHING & ROUTING
1. Video switcher / router shall have (6) HDMI inputs, (2) configurable inputs, and (2) twisted pair inputs
2. The switcher shall have (2) twisted pair outputs
3. The twisted pair signal must pass control protocol and video
4. Acceptable manufacturer/model, or better than:
    a. Extron IN 1608xi

V. VIDEO RECEIVER
1. The receiver shall be compatible with HDBaseT compliant devices
2. The unit shall function as a receiver, video scaler, and control interface
3. A single scaled HDMI or DVI display output.
4. The unit shall be HDCP compliant
5. Acceptable manufacturer/model, or better than:
    a. Extron DTP HDMI 4K 230 Rx

W. BLU-RAY PLAYER
1. Shall play back Blu-ray, DVD, and CD media
2. Playback WAV, MP3, WMA, and other audio formats
3. RS-232C serial control
4. Infrared remote control included

5. Acceptable manufacturer/model, or better than:
    a. Tascam BD-MP1

X. CONTROL SYSTEM – WIRED TOUCH PANELS
1. Refer to drawings to verify the location
2. Displays type shall be a 7” TFT active matrix color LCD, 5-point multi-touch
3. Provide necessary mounting bracket for rack mount panel
4. Provide a PoE connection for power for wired touch panels
5. Acceptable manufacturer/model, or better than:
    a. QSC TSC-70-G3

Y. CONTROL SYSTEM – POWER CONTROL RACK
1. The power controllers shall be rack mounted
2. The power controller shall have 4 duplex outlets
3. The total power rating shall be 15A
4. The unit shall come with an attached 6 ft power cord
5. Acceptable manufacturer/model, or better than:
    a. Lowell RPC-4

Z. CONTROL SYSTEM – POWER CONTROL SURFACE MOUNT
1. The power controllers shall be stand-alone surface mount
2. The power controller shall have 1 duplex outlet
3. The total power rating shall be 15A
4. The unit shall come with an attached 6 ft power cord
5. Acceptable manufacturer/model, or better than:
    a. Lowell RPC-15

AA. PERFORMANCE LIGHTING CONSOLE
1. 2048 DMX channels
2. 40 multi-function faders
3. 3 DMX outputs
4. 10 master playback faders
5. 9.7” touch panel

6. Acceptable manufacturer/model, or better than:
    a. Chamsys QuickQ 30

BB. LIGHTING WALL BUTTON PANELS
1. Provide 1-gang 5-button panels at designated locations in the auditorium for lighting control
2. Acceptable manufacturer/model, or better than:
    a. ETC Heritage Station, black (Confirm finish prior to ordering)

CC. LIGHTING DIMMER RACK
1. Dimming 24-position relay panel with support for one-, two-, or three pole relays and support for 300W phase adaptive dimmers
2. Built-in EchoConnect power supply for up to 6 Echo stations/ sensors and 5 output products
3. 14 in. width and 4 in. depth allows the cabinet to be flush- or surface-mounted in standard stud-width construction
4. UL924 LISTED emergency control bypass contact input
5. Acceptable manufacturer/model, or better than:
    a. ETC ERP-24R1-24B1 Relay Enclosure 120/208V

DD. PERFORMANCE LIGHTING – LED PAR FIXTURES
1. The performance lighting par fixtures shall use LED technology
2. Light Source: LED emitters
3. The fixtures shall have 50,000 Hr. life expectancy
4. Acceptable manufacturer/model, or better than:
    a. ETC ColorSource PAR

EE. PERFORMANCE LIGHTING – LED ELLIPSOIDAL FIXTURES
1. The performance lighting ellipsoidal fixtures shall use LED technology
2. Light source combination of red, green, blue, lime green LED’s
3. The fixtures shall have 54,000 Hr. life expectancy
4. Supply assortment of 5°, 10°, 14°,19°, 26°, 36°, 50°, 70° lens tubes as needed
5. Acceptable manufacturer/model, or better than:
    a. ETC ColorSource SPOT V

FF. PERFORMANCE LIGHTING – CYC FIXTURES
1. The performance lighting cyc fixtures shall use LED technology

2. The fixture shall have 24 LED engines
3. Variable effects engine; strobe, strobe on top, strobe random
4. Hot lumen output (combined) 18,600
5. The fixtures shall have 50,000 Hr. life expectancy
6. Beam angle approximately 22°
7. Acceptable manufacturer/model, or better than:
    a. ETC Colorsource Cyc

GG. PERFORMANCE LIGHTING – FOLLOWSPOT SPOTLIGHT

1. 5,500 K cool white spot with 9° to 17° zoom
2. Color Temperature (at full): 5640 K
3. Input Voltage: 100 to 240 VAC, 50/60 Hz (auto-ranging)
4. 6-position, removable color changer
5. Manual linear dimmer
6. Full blackout, 24-leaf iris
7. Acceptable manufacturer/model, or better than:
    a. Chauvet Professional Ovation SP-300CW

HH. DMX SPLITTER

1. Isolated DMX input, 12 DMX outputs
2. DIN rail mount
3. Acceptable manufacturer/model, or better than:
    a. Doug Fleenor DIN1212

II. AV FLOOR BOXES

1. Provide floor boxes as indicated on drawings.
2. Acceptable manufacturer/model, or better than:
    a. FSR

JJ. EQUIPMENT RACKS – TYPE A

1. This equipment rack spec shall be used in along with the rack elevation details on the drawings.
2. The rack shall be a wall-mount pivoting communications rack.

3. The rack shall be the 46 rack unit and 28” deep, with standard 19” width for equipment mounting.
4. The rack shall pivot 90 degrees on its floor base.
5. Each rack shall have a logo panel of the system designer and integrator’s name and contact info.
6. The racks shall be equipped and priced with these following rack panel options
    a. 1RU LOGO panels
    b. 1RU solid blank panels
    c. 2RU solid blank panels
    d. 3RU solid blank panel
    e. 1RU brush grommet
    f. 1RU sliding shelf
    g. 2RU utility drawers
    h. 3RU utility drawers
    i. Vertical power distribution strip
    j. Horizontal lacing bars
    k. Rack light(s)
7. Acceptable manufacturer/model, or better than:
    a. Middle Atlantic SR series

KK. INFRASTRUCTURE

1. Cable – Analog audio
    a. Mic, line, speaker, intercom
    b. Acceptable manufacturer/model, or better than:
        1) Belden
        2) West Penn
        3) Clark

LL. Cable – Video Baseband & Broadband

1. HD-SDI, analog video, RF
2. Acceptable manufacturer/model, or better than:
    a. Belden

b. West Penn

c. Clark

MM. Cable – CAT5e / CAT6

1. Network, twisted pair video transmission (HDBaseT, DM, TP)

2. Acceptable manufacturer/model, or better than:

a. Belden

b. West Penn

2.2 BASIS OF DESIGN

A. Contractor shall be responsible for including all devices necessary to ensure a fully operational and complete A/V/L system.

B. Basis of Design equipment used to create signal flows and other documentation.

Qty	Manufacturer	Model	Description
		AUDIO SYSTEM	
1	Soundcraft	SI Performer 2	Digital Audio Mixer
1	Soundcraft	MSB-16i	Digital Mixer Stage Boxes
4	JBL Pro	AM5212/95	Main Loudspeaker, Black
2	JBL Pro	ASB6115	Subwoofer, Black
2	JBL Pro	JRX212	Stage Wedge Monitors

Qty	Manufacturer	Model	Description
		AUDIO SYSTEM	
1	Clear-Com	MS-702	Headset/Speaker Main Station, 2 Channel
5	Clear-Com	RS-701	Belt Packs
5	Clear-Com	CC-300-X4	Headsets
1	Listen	LS-55-072	Level II Stationary RF Assistive Listening System w/ Accessories
1	Listen	LP-41-072-01	12-Pack Receiver Kit
1	QSC	CORE 110f	Digital Audio Signal Processor w/ Licenses
1	Crown	CDI4X600	4-Channel Amplifier
1	Crown	CDI2X300	2-Channel Amplifier
1	Crown	CDI2X600	2-Channel Amplifier
2	Sennheiser	ASA 214	Wireless Antennas/ Distribution
6	Sennheiser	EW-D ME2/835-S	Wireless Mic Kit
1	Sennheiser	EW-D 835-S	Wireless Mic Kit
1	Tascam	CD-400U	CD/Media Player

1	Cisco	CBS-350-24FP-4G-NA	Dante Network Switch
Lot	Miscellaneous	As Required	I/O plates for Mic, Line, Speaker, Intercom, Rack Panels, & Network Signal Patching (see drawing details)
Lot	Miscellaneous	As Required	Plenum Rated Bulk Audio and Control Cable
Lot	Miscellaneous	As Required	Cables, Connectors, Hardware, & Accessories Required for Complete Installation

Qty	Manufacturer	Model	Description
		AUDIO DELIVERA-BLES	
1	Listen	LP-41-072-01	Receiver Kit
3	Sennheiser	004513	Wireless Vocal Microphone
3	Sennheiser	E609	Instrument Microphones
6	K&M	MS7701B	Microphone stand w/ boom
1	SKB Cases	31-1610-MCB	Storage Cases for Vocal and Instrument Micro-phones
2	PROCO Sound	DB1	Direct Box
5	PROCO Sound	AQ-15	15ft F/M XLR Mic Cable
5	PROCO Sound	AQ-25	25ft F/M XLR Mic Cable
2	PROCO Sound	EVLGCN-25	25ft ¼” Instrument Cable
2	PROCO Sound	LSCNN-25	25ft NL4 Monitor Speaker Cable

Qty	Manufacturer	Model	Description
		VIDEO SYSTEM	
1	Chief	WMA2S	Projector Wall Mount
1	Draper	Custom	278" Diagonal Motorized Screen w/ Black Drop
1	Epson	EB-PU1008B	8,000 Lumen LCD Laser Projector
1	Epson	ELPLW05	Short Throw Lens

1	Extron	60-1238-81	IN1608xi Video Switcher
1	Extron	60-1271-12	HDMI Twisted Pair Transmitter
1	Extron	60-1271-13	HDMI Twisted Pair Receiver
1	Tascam	BD-MP1	Blu-ray Player
1	PSC	Miscellaneous	Projector Mounting Hardware, Pipe, etc.
1	Miscellaneous	As Required	Bulk Cable, Plates, Connectors, Interconnect Cables, Rack Panels, & Installation Accessories as Required
Lot	West Penn	As Required	Plenum Rated Bulk Video and Control Cable
Lot	PSC	Miscellaneous	Cables, Connectors, Hardware, & Accessories Required for Complete Installation

Qty	Manufacturer	Model	Description
		CONTROL SYSTEM	
2	QSC	TSC-70-G3	7” LCD Touch Panel
1	Lowell	RPC-4	Control System
3	Lowell	RPC-15	Power Controls Surface Mount
1	Miscellaneous	As Required	Plates, Connectors, Interconnect Cables, Rack Panels, & Installation Accessories as Required
Lot	West Penn	As Required	Plenum Rated Bulk Video and Control Cable
Lot	PSC	Miscellaneous	Cables, Connectors, Hardware, & Accessories Required for Complete Installation

Qty	Manufacturer	Model	Description
		LIGHTING SYSTEM	
1	Chamsys	CHAMQUICKQ30	Lighting Console
20	ETC	7412A1005-A	ColorSource PAR LED Fixture, Black, w/ Safety Cable, Clamp, Power & DMX Cables
10	ETC	7413A1011-A	ColorSource Spot V LED Ellipsoid Fixture, Black, / Safety Cable, Clamp, Power & DMX Cables

10	ETC	7060A2002-K	419LT 19° lens tube, Black, Final Lens TBD
8	ETC	7415A1000-A	ColorSource CYC w/ Safety Cable, Clamp, Power & DMX Cables
1	Doug Fleenor Design	1212-DIN-JBOX-PS	DMX Splitter
1	Chauvet	SP-300 CW	Ovation Followspot Light
Lot	Light Source	Various	1 1/2" Schedule 40 Pipe, Pipe Splices, Clamps
1	Miscellaneous	As Required	Plates, Connectors, Interconnect Cables, Rack Panels, & Installation Accessories as Required
Lot	West Penn	As Required	Plenum Rated Bulk Video and Control Cable
Lot	PSC	Miscellaneous	Cables, Connectors, Hardware, & Accessories Required for Complete Installation

Qty	Manufacturer	Model	Description
		STAGE CURTAINS	
1	Greenville Stage	Custom	5' Tall x 40’ Wide Grand Valance
2	Greenville Stage	Custom	16' Tall x 20’ Wide Grand Curtain Panel
2	Greenville Stage	Custom	4' Tall x 40’ W Border Curtain
2	Greenville Stage	Custom	16' Tall x 7’ W Leg Curtain
1	Greenville Stage	Custom	16’ Tall x 20’ Wide Mid Traveler Curtain
2	Greenville Stage	Custom	16’ Tall x 20’ Wide Rear Traveler Curtain
1	Greenville Stage	Custom	16' Tall x 40' Wide Muslin Cyc Curtain
Lot	ADC	Track	Curtain Track and Accessories

Qty	Manufacturer	Model	Description
		EQUIPMENT RACKS	
1	AC Infinity	AI-CPT1-N	Quiet Rack Cooling Fan System
1	Middle Atlantic	D3LK	3SP Locking Drawer

1	Middle Atlantic	Logo Panel	Black Rack Panel w/ PSC Contact Info
1	Middle Atlantic	ERK-1825LRD	18 space Equipment Rack
1	Middle Atlantic	LBP-1A	Horizontal Lacing Bars
1	Middle Atlantic	SR-46-28	46space Swinging Wall Rack, Vented Front Door
2	Prime Wire	PB801120	Black Metal Power Strip
1	Middle Atlantic	Various	Rack Blank Panels, Vent Panels, Cable Management, Power Distribution, UPS, & Accessories as Required

EXECUTION

2.3 ACCURACY OF DATA

A. It shall be the sole responsibility of the Contractor to verify all dimensions, take his own field measurements, and install all work to suit conditions encountered on the job site.

B. The drawings are generally diagrammatic and except where dimensions are indicated are not intended to show exact locations of outlets, conduits, etc. All work shall be installed as nearly as possible in the locations indicated, with minor adjustments as required to avoid interferences with structure or the work of other trades.

C. Prior to beginning work, the Contractor shall carefully examine all construction drawings and the job site and report to the Owner any discrepancies or interference that may be discovered. If, during construction, any such discrepancies or interferences are noted, the Contractor shall promptly report them to the Owner. Failure to report such discrepancies or interferences shall result in the correction of the same at the Contractor's expense. All work under this specification, which either interferes with the architectural or any other work or deviates from the drawings and specifications without prior approval of the Owner, shall be altered by the Contractor at his expense. These alterations shall clear such interferences or shall comply with the drawings and specifications as directed by the Owner.

2.4 MECHANICAL

A. Except for portable equipment, all other equipment must be permanently installed. This shall include equipment racks, speakers, cables, etc. Fastenings and supports must provide a safety factor of at least three times that required for safe support. Precautions must be taken to prevent electrostatic and electromagnetic hum and radio frequency interference. All electronic equipment must be easily accessible and have adequate ventilation.

2.5 CONNECTIONS

A. All low voltage wiring connections must be made with rosin core solder or mechanical connectors as specified. Terminations on all cable must be dressed properly with shrink tubing. All low voltage control level connections to terminal blocks are to be made with crimp on spade lugs. All crimp on connectors must be fastened with the proper tool as specified by the manufacturer. Improper crimping will be cause for rejection. All "drain" wires on microphone and line level terminations are to be properly dressed using transparent shrink tubing to avoid the possibility of shorting "whiskers".

2.6 LABELS

A. All wiring is to be numbered on both ends with “EZ Code” type markers. Wire numbers are to be secured with transparent shrink tubing. Wire numbers are to follow a logical sequence and are to be listed on the proper document. “Brady” type labels are acceptable.

2.7 INSTALLATION

A. General

1. Installation shall include the delivery to the installation site, unloading, setting in place, mounting, and securing equipment to walls, floors, ceilings, cabinetry, or other structures. Also, interconnection of any cables, wires, fiber optics, or other infrastructure. Any

equipment alignment, adjustments, menu settings, or other requirements to ensure the appropriate operation of the system.

2. All installation practices shall be in accordance with, but not limited to, these specifications, drawings, and intended system performance. Installation shall be in accordance with the AV industries best practices as outlined in AVIXA CTS-I criteria. Local and National authorities having jurisdiction.

3. If in the opinion of the AV System Contractor, an installation, an installation practice is desired or required, which is contrary to these specifications and/or drawings, a written request for modification shall be made to the Consultant. Modifications shall not commence without written approval from the Consultant. Every effort will be made to respond to all written requests in a timely manner so as to not delay the installation or completion of the project.

4. During the installation, and up to the date of final acceptance, the AV Systems Contractor shall be responsible and under obligation to protect finished and unfinished work against damage and loss. In the event of damage or loss, those items shall be replaced at no cost to the Owner.

2.8 SOUND SYSTEM TEST AND MEASUREMENT

A. The contractor is to conduct a performance verification test for the Owner. The contractor must complete the installation and verify that it is in working order and conforms to the following performance criteria. These performance standards are set forth as an indication of a properly installed and functioning sound system. It is implied through his action of submitting a bid that the contractor has reviewed these documents and is in agreement with the concept and execution of the design of the specified sound system. No financial adjustments will be allowed for discrepancies discovered after bid is accepted.

1. In rooms where voice lift or voice reinforcement is required, there is a programmable DSP in the system. The contractor is expected to tune the system to eliminate any hot frequencies in the room that would cause premature feedback as well as blemish the sound quality of the microphones.

2. Microphone line resistance: Less than 1.7 Ohms with short at input jack. Measured from mixer end of microphone cable. Measure with Ohm meter.

3. Maximum amp output: 100% of rated power at less than 0.25% THD. Measure with distortion analyzer.

4. Signal to noise ratio: Better than 80 dB or an absolute noise level less than 62 dBm for systems with +18 dBm maximum line operating level. Measured at amplifier input with RMS voltmeter with dB scale.

5. Audio frequency response: +/- 1 dB 50 Hz to 15 kHz control equalizer set flat and room equalizers switched out – Microphone input to amplifier output. Measure with RTA.

6. Polarity: All microphones and source equipment are to be wired so as to be in absolute polarity with the loudspeaker systems. Measure with polarity checker.

7. Synchronize delay and fill systems to within 15 milliseconds of first arrival of primary loudspeaker system as measured on Smaart or TEF measurement systems.

8. Acoustic coverage: Maximum +/- 3 dB SPL variance front to rear / side-to-side in audience area through the 4 kHz full octave band. Measure with octave band Sound Level Meter.

9. Acoustic amplitude response: With the room equalizers switched in +/- 3 dB maximum deviation from the following curve averaged from three test positions in the audience area flat 60 Hz to 2 kHz, 10 dB at 50 Hz and 12 kHz. Measure with RTA.

10. Electroacoustic gain: No less than 15 dB from 500 Hz to 4 kHz with one microphone and 12-inch source to microphone distance. Gain is to be measured 50 feet from the source. Measure with Sound Level Meter.

11. Maximum sound level: Greater than 85 dB-C for large conference spaces when amplifier occasionally clips on program peaks. Measure with Sound Level Meter.

12. Acoustic noise floor: No audible hum, hiss, or R.F. interference shall be audible under normal room conditions in audience seating area and stage or platform areas.

13. All loudspeakers are to exhibit the same acoustic polarity. Measure with Polarity Checker (Galaxy Cricket).

2.9 VIDEO SYSTEM PROOF OF PERFORMANCE

A. Verify all devices and cables match information on final drawings
B. Test all inputs on video switcher / scaler.
C. Adjust Color Temperatures on projectors to accurately reproduce NTSC and RGBHV Data Color Bars.
D. Adjust projector images to match screen size, eliminating any overscan, underscan, or keystone.
E. Adjust all switching functions to eliminate sync roll or glitches upon switching.
F. Test all video sources for full operation. Test all data sources up to maximum resolution of the display, (projector, LED display, or video wall).
G. Test audio output of switcher scaler. Verify that all input audio levels are equal. Verify maximum audio output not to exceed +4dB.
H. Verify there’s no 60hz grounding interference aka “humbars” existing in displayed images. If so thoroughly go through and verify that grounding procedures are implemented.
I. Optimize projector contrast, sharpness and brightness to avoid blooming and achieve optimal black level.

2.10 AV SYSTEMS CONTRACTOR CHECKOUT

A. Before the Consultants Acceptance Tests are scheduled, the AV Systems Contractor shall perform his own system check-out. The Systems Contractor shall furnish all required test and measurement equipment needed to perform all work necessary to adjust, modify, and document the systems as it is specified to perform.
   1. Provide documentation that all digital and analog audio signal paths have been tested and verified.

2. Provide documentation of sound system performance as outlined above.
3. Provide documentation that all digital and analog video signal paths have been tested and verified. This includes all SDI, HDBaseT, DVI, HDMi, and other digital video transports.
4. Test all systems for compliance and performance using the following equipment or equipment that provides the same testing for more current state-of-the art systems.
    a. Audio testing:
        1) Signal generator
        2) AC millivolt meter
        3) Audio test set
        4) Source media (MP3, CD's, 1/8" stereo source)
        5) Any needed adapters
    b. Video checks:
        1) Analog video generator (if applicable)
        2) Digital video signal generator
        3) Waveform/Vectorscope (if applicable)
        4) Prerecorded DVD or Blu-ray test disc
        5) Video cables and adapters
5. Ensure all gain settings, noise floor, gain before feedback, and signal to noise measurements are acceptable and in accordance with industry best practices.
    a. Provide written documentation to support all audio adjustments and settings.
    b. DSP
        1) In accordance to the specification and drawings, ensure that the DSP is programmed accordingly to deliver the intended operation. Verify all settings and programming for the proper operation of the following:
            a) All communication and IP settings.
            b) Proper or current software version
            c) Matrix routing / presets
            d) Correct input and output names, gain settings, phantom power, and phasing
            e) Correct NOM (number of open mics) and/or mix-minus settings
            f) Automatic gain control (AGC) settings

g) Automatic mixer settings if applicable

h) Limiters, filters, and compressor settings

i) Equalization – Room tuning

j) AEC settings

k) Delay setting (if applicable)

l) Audio teleconference settings such as Auto Answer and disconnect, VoIP settings. Control system phone number availability (speed dial list) for phone calls.

m) Programmer to document that all DSP functions are working properly in accordance to the specifications and drawings.

c. Video switchers

1) Ensure buttons are labeled as to the input source and output destination.

2) Make sure all resolutions are correct.

3) Verify HDCP keys are handled correctly

4)

6. All optical fiber runs to be certified using industry accepted test equipment. Fiber connections to have documentation supporting the follow tests:

a. Measuring insertion loss

b. Measurements from the OTDR

7. Adjust, balance, and align all equipment for optimum quality and to meet the manufacture's published specifications. Record all "normal" settings in the "System Operation Manual"

2.11 SYSTEM ACCEPTANCE TESTS

A. System acceptance tests shall not be performed until the AV Systems Contractor Checkout has been completed and the test results have been reviewed. The System Acceptance Test will be supervised by the consultant and will consist of the following:

1. A physical inventory will be taken of all equipment on site and will be compared to the equipment list in the contract documents.

2. The operation of all system equipment shall be demonstrated by the AV Systems Contractor.

3. The AV Systems Contractor shall provide the necessary equipment for the Consultant to perform the AV tests.

4. The AV System Contractor shall have on site and available the latest as-built drawings, equipment inventory list, and manuals. One set of these documents to have been sent to the Consultant prior to Acceptance Test.

B. Additional work by Consultant:
   1. In the event of defective equipment, or other adjustments need to be made, the test may be postponed or continued later at the option of the Consultant.
   2. However, if there is a return trip necessary by the consultant and/or a member of the consultants team as a result of improper installation or a failed system for performance standard, the consultant may charge the AV System Contractor directly or be deducted directly from payments (or the final payment) to the contractor. Hourly rates for the Consultant and various team members are as follows:
      a. Consultant $125
      b. Project Engineer $95
      c. Programmer $110
      d. Network Engineer $125
   3. Additional travel expenses such as a rental car or mileage will be billed as a cost plus 10% markup and would be charged along with the labor.

2.12 THIRD PARTY TESTING AND COMMISSIONING

A. In addition to the standard system testing and commissioning as stated in this section, the owner has authorized an additional allowance for a 3rd party to perform, but not limited to, final system tests, sound system tuning, level calibrations, control settings, and commissioning.
B. See Section 012100 for more information on this allowance.

2.13 DOCUMENTATION

A. Upon final completion of the system a documentation package / manual is to be turned over to the Owner and include the following items:
   1. System signal flow diagrams (for audio, video, and control) showing all components, interconnections, and connector types and wire numbers. As-built revisions are to be noted on the submittal drawings.
   2. Manufacturer instruction manuals for all electronics.
   3. Product specification sheets for all equipment without instruction manuals such as microphones, loudspeakers, and lighting instruments.
   4. Copies of the proof of performance data. Provide one original (no photocopies) and one copy (photocopies are acceptable) of the total documentation package.
   5. A single copy of the system signal flow diagram with wire numbers indicated is to be laminated and posted in the door of the sound equipment rack.

6. Special documentation is required as part of the Owner training and operation of the systems. This documentation is to consist of instruction sheets that describe the operation of the system from the stage. Each instruction sheet is to be step by step "cookbook" with touchscreen panel screen shots with arrow indicators that describe step and function. A laminated poster version of this instruction sheet is to be mounted on the side of each equipment rack. The bullet points detailed on this sheet include:

    a. Turning on system power.

    b. Select desired source.

    c. Adjust volume levels

    d. Select lighting presets (where applicable)

    e. Recording stop/start functions (where applicable)

    f. VTC calling functions (where applicable)

    g. Other functions of the Owner control panel.

2.14 CLEAN UP

A. During construction periodically remove discarded containers and refuse from the job site. At the completion of the job the sound system components and equipment areas are to be left clean and neat and all refuse removed from the site.

2.15 TRAINING

A. The AV System Contractor is to provide at least fourteen hours (2 each six to eight-hour sessions) of training to person(s) selected by the Owner on operation and basic maintenance of all systems and equipment. In addition to training, a representative of the AV System Contractor knowledgeable of the system installation and operation is to be present for the first special events selected by the Owner that all or any part of the sound and video systems is used. The training and event attendance is to take place during the 30-day period after system completion.

END OF SECTION 274116

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SECTION 31 1000

DEMOLITION, CLEARING, AND GRUBBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Related work described elsewhere includes:
1. Geotechnical Data; Section 02 0600.
2. Earthwork, Section 31 2300.
3. Erosion and Sedimentation Control; Section 31 2500.

1.02 SCOPE OF WORK

A. It is the intent that, under this contract, a portion of the site, as defined on the drawings and / or as required for construction activities, be cleared and grubbed in preparation for the earthwork.

B. This Section includes, but is not necessarily limited to, the following:
1. Protection of existing trees.
2. Felling of trees and removal of stumps, roots, tree debris, and other vegetation within the defined "Limits of Work".
3. Topsoil stripping.
4. Clearing and grubbing.
5. Removal of wood framed structure(s) completely, including but not limited to above ground construction, foundation walls, footings, and basements.
6. Removal of concrete loading dock structure(s).
7. Removing above-grade improvements.
8. Removing below-grade improvements.
9. Removal of miscellaneous debris; Debris includes residential garbage, construction materials and other material not indigenous to site.
10. Construction of necessary barriers and barricades where required.

1.03 DEFINITIONS

A. The term "demolition, clearing, and grubbing" as used herein, includes the removal of all existing objects, except for those designated to remain, down to existing ground level, plus other work as described herein.

B. The term "clearing" shall consist of felling, cutting up, and satisfactory disposal of all trees, bushes, shrubs, vegetation and debris occurring within area to be cleared.

C. The Term "grubbing" shall consist of the removal and disposal of all stumps, roots larger than 1/2" in diameter to a minimum depth of 2'-6" below finished grade, and matted roots from areas designated for clearing.

1.04 QUALITY ASSURANCE

A. Qualifications of workmen: Provide at least one person who shall be present at all times during demolition, clearing and grubbing operations, and who is thoroughly familiar with the work involved and who shall be responsible for directing the work.

B. Code and Standards:
   1. Conform to all Federal, State, and Local laws and regulations.
   2. In addition to complying with all pertinent codes and regulations, comply with the requirements of those insurance carriers providing coverage for this work.

1.05 PROJECT CONDITIONS

A. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place.
   1. Protect improvements on adjoining properties and on Owner's property.
   2. Restore damaged improvements to original condition, and acceptable to property owner.

B. Protection of Existing Utilities: Provide adequate facilities for protecting all utilities which may be present on the project site.
   1. In the event of damage, immediately make repairs and replacements necessary. Where damaged item is a public utility the contractor shall arrange to have utility repair damage.
   2. All costs for repair to be paid by contractor.
   3. All work subject to approval of Architect.

C. Streets and Highways: Provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets and highways and in other locations where required for the protection of work and safety of public.
   1. Provide with lights, barricades or obstructions which encroach on, or are adjacent to public right-of-way. Keep lights burning at all times from sunset to sunrise.

D. Traffic Services: Arrange work to cause minimum of disturbance to vehicular and pedestrian traffic.
   1. Provide adequate means of access to all public and private properties during construction.
   2. Do not close or obstruct streets, walks, or other used facilities without permission from authority having jurisdiction.

E. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.
   1. Provide temporary guards to protect trees and vegetation to be left standing.
   2. Provide protection for roots over 1-1/2" dia. cut during construction operations.
      a. Coat cut faces with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues.
      b. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth soon as possible.
   3. Repair or replace trees and vegetation indicated to remain, but damaged by construction operations, in manner acceptable to Architect.
   4. Employ licensed arborist to repair damages to trees and shrubs.
   5. Replace trees which cannot be repaired and restored to full-growth status, as determined by arborist.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Where fill is required, all dirt shall be free from vegetation and debris and shall be obtained from a site approved by Geo Technical Laboratory, Architect and/or Civil Engineer.
   1. Fill material shall comply with requirements of Section 02300, Earthwork.

B. All other materials not specifically specified, but required for proper completion of work specified, shall be as selected by contractor, subject to approval by Architect.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Notification: Notify Architect at least one full week prior to commencing work.

B. Site Inspection: Prior to performing any work under this section, carefully inspect the entire site and all objects designated to be removed and preserved.
   1. Locate all existing utility lines and determine all requirements for disconnecting and capping or relocating.
   2. Locate utility lines traversing the site and determine the requirements for their protection.

C. Clarification: The drawings do not purport to show all objects existing on the site.
   1. Before commencing the work the contractor shall verify with the Architect all objects to be removed and all objects to be preserved. The contractor shall be responsible for removal of existing construction as necessary to accommodate new construction, whether specifically shown on drawings or not.

D. Scheduling: Schedule all work in a careful manner with all necessary consideration for neighbors and the public.
   1. Avoid interference with the use of, and passage to and from, adjacent buildings and facilities.

E. Protection of Utilities: Preserve in operating condition all active utilities traversing the site where not indicated to be removed or relocated.

F. Limits of Demolition, Clearing and Grubbing: The limits of demolition, clearing and grubbing are shown on the contract drawings and / or as necessary to perform specified new work.
   1. The limits of the clearing and grubbing shall include all areas shown to receive new construction (building, walks, drives, etc), all areas where grading activities are indicated and 10'-0" outside the limits of these areas.
   2. Additional areas shall be as shown and / or noted on plans and as required for construction of project including space for control stakes and hubs.

3.02 DEMOLITION

A. Demolish all buildings, foundations, basements, walls, concrete slabs, concrete walks, asphalt walks, asphalt and concrete paving and curb and gutter where existing within the limits of the clearing and grubbing.

B. Remove all existing septic tanks, fuel tanks, abandoned utility lines and leaching lines within limits of work. Observe all requirements of environmental protection agencies having jurisdictional authority, especially if petroleum or other hazardous substances encountered.

C. Remove existing above-grade and below-grade improvements indicated and where necessary to facilitate new construction.

D. Refill depressions left as a result of removing improvements. Use suitable structural fill materials compacted to densities indicated and to make surface conform to surrounding areas. Fill abandoned wells according to procedures of agency having jurisdiction or where none exist in accordance with requirements for structural fill as defined in Section 02200.
   1. Compact materials in maximum 8" lifts to min. 98% standard proctor where under pavement, walks, building or other improvements and 90% standard proctor where under lawns.

3.03 CLEARING

A. Within the "Limit of Work": Remove trees, bushes, grass, shrubs and other vegetation, improvements, or obstructions required to permit installation of new construction.
   1. Remove rubbish, vines, undergrowth to ground level and below.
   2. Remove obstructions resting on or protruding through the surface of the ground.

3. "Removal" includes digging out and off-site disposing of stumps and roots.

B. Trees and shrubs which are to remain in place shall be trimmed and shall be carefully protected from injury and defacement.
   1. Limbs and branches required to be trimmed shall be neatly cut close to bole of tree or to main branches.
   2. Cuts shall be painted with an approved pruning paint in strict accordance with manufacturers recommendations.

3.04 GRUBBING

A. Within "Limit of Work": Excavate and Remove stumps, roots, logs, limbs, and other timber more than 1/2 inch in diameter, matted roots and other debris to a depth of not less than 2'-6" below the surface of the grade, shoulder, or slope.
   1. All depressions remaining as a result of removal of roots, stumps and other debris shall be refilled with suitable material, compacted to 90% standard proctor to make surface conform with surrounding ground surface.
   2. Ground surface shall be left smooth, uniform, and free of deleterious material. No roots or other debris shall be visible.

3.05 TOPSOIL

A. Remove heavy growths of grass from areas being stripped.

B. Remove top soil and stock pile on site for future redistribution during final grading phase of project.
   1. Topsoil defined as friable clay loam surface soil found in depths of 4-8" as indicated in soils report.
   2. Satisfactory Topsoil defined as reasonably free of subsoil, clay lumps, stones, and other objects over 2" in dia., and without weeds, roots, and other objectionable material.

C. Strip topsoil to whatever depths encountered in manner to prevent intermingling with underlying subsoil or other objectionable material.
   1. Top soil to be stripped from entire area of site on which new construction is to be placed and 10'-0" beyond such new construction.
   2. "New Construction" shall include building, paving, walks and other work performed under this contract.
   3. Where existing trees indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.
   4. Stockpile topsoil in storage piles in areas indicated or directed.
      a. Construct storage piles to provide free drainage of surface water.
      b. Cover storage piles to prevent wind erosion.
      c. Silt Fence shall be placed along entire base of stockpile.

3.06 LEVELING

A. Contractor shall, using mechanical equipment, smooth and level rough spots on the site .
   1. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork indicated.
   2. Place fill material in horizontal layers maximum of 6" thick, loose depth, and thoroughly compact to a density equal to original ground.

3.07 DISPOSAL OF WASTE MATERIAL

A. Within "Limits of Work":
   1. Remove all material and debris from site.
      a. Ground surface shall be left smooth, uniform and free of irregularities.
      b. Ground surface shall be free of visible vegetation.

2. Remove all "unsuitable" soil and top soil from Owner's property.
3. Redistribute excess top soil on Owner's property; location as directed by Architect.

B. On Site Burning: Where on-site burning of vegetation (trees, stumps, ect.) is acceptable and is to be performed comply with following:
1. Contractor to obtain a burning permit from agencies having jurisdiction.
2. Burn only when allowed by agencies having jurisdiction.
3. Provide protective systems and measures recommended by agency having jurisdiction and as required to prevent the spread of fire to areas of site not scheduled to be cleared and as required to prevent fire and smoke damage to trees not scheduled to be removed.
4. Perform burning in designated and approved areas only.
5. Contractor to be responsible for all costs including permits and fire and smoke protection systems.
6. Contractor responsible for coordinating with officials having jurisdiction.

C. Removal of Contaminated Soil
1. Soil from old septic field and trash areas are considered to be contaminated soil. Contaminated soils shall be taken to an approved landfill. Contractor to pay costs associated with disposal.

D. Removal of Debris:
1. Material not burned shall be removed of and disposed of off site in a legal and approved manner; Contractor to pay for all costs of disposal.
2. On site burying of material **NOT** acceptable.

END OF SECTION 31 1000

SECTION 31 2300

EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes, but not necessarily limited to, the following:
1. Excavation as shown or required to attain specified grades.
2. Surface and subsurface dewatering.
3. Filling and backfilling as shown and required to attain finished grades shown.
4. Rough and finished grading of site.
5. Preparing of subgrade for building foundations, slabs, walks, and pavements.
6. Installation of Drainage fill course for support of building slabs.
7. Excavation and backfilling of trenches within building lines.
8. Final Grading and redistribution and preparation of top soil.

B. Related work described elsewhere:
1. Quality Control Services 01 4000
2. Demolition, Clearing and Grubbing: Section 31 1000.
3. Trenching; Section 31 2333.

C. Quantity of Soil removal to be included in the contractor’s base bid:
1. Refer to Section Allowances

1.03 WORK INCLUDED IN THIS CONTRACT

A. Current Contract: The contractor, under the scope of this contract shall provide additional required earthwork activities necessary to complete work in accordance with the requirements of the contract documents and as described herein:
1. Provide building drainage coarse as herein indicated.
2. Remove/add soil necessary to obtain level building pad and remove 'crown'.
3. Maintain grades and elevations of site for duration of contract.
4. Grade around building perimeter from building line to 50'-0" from building line to provide positive and uniform drainage away from building.
5. Grade as necessary to provide positive drainage into storm drainage collection structures.
6. Upon completion of construction activities, restore grades to within 0.10 feet of indicated grades and elevations.

B. Acceptance of Site: Prior to commencement of construction activities the contractor shall perform surveys and tests necessary to provide, to the contractor's satisfaction, verification that the site conditions related to grades and compaction, are as indicated on contract documents.
1. Costs for tests and surveys requested or performed by the contractor shall be at the contractor's expense.
2. The mobilization by the contractor shall be considered as acceptance of the site conditions as being suitable for the performance of work under this contract.

1.04 DEFINITIONS

A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect; unauthorized excavation, as well as remedial work directed by Architect, made at Contractor's expense.
   1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
   2. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.
   3. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

C. Additional Excavation:
   1. When excavation has reached required subgrade elevations, notify Architect, who will make inspection of conditions.
   2. If Architect determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Architect.
   3. Contract Sum may be adjusted by an appropriate Contract Modification.
   4. Removal of unsuitable material and its replacement as directed will be paid on a unit cost basis. Unit costs shall be in accordance with prices submitted on proposal form, Section B.

D. Subgrade: Undisturbed earth or compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.05 SUBMITTALS

A. Test Reports: Submit the following reports directly to Architect from the testing services, with copy to Contractor:
   1. Test reports on borrow material.
   2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
   3. Field reports; in-place soil density tests.
   4. One optimum moisture-maximum density curve for each type of soil encountered.
   5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.06 QUALITY ASSURANCE

A. Codes and Standards: Perform work specified in compliance with applicable requirements of authorities having jurisdiction. Applicable standards include, but are not limited to:
   1. Density of Soil In Place, Sand Cone Method; ASTM D1556.
   2. Moisture Density Relationship of Soil, 5.5# rammer and 12" Drop; ASTM D698.
   3. Density of Soil In-Place, Drive Cylinder Method, ASTM D 2937.

B. All work to be performed in accordance with applicable provisions of the Southern Standard Building Code, OSHA Safety Requirements, State and Local Ordinances and other authorities having jurisdiction.

C. All Construction shall comply with the Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926, subpart P, revised July 1, 1995.

D. Testing and Inspection Service: An experienced soil engineer technician, under the direct supervision of an independent geotechnical engineer shall observe all proof rolling, excavation, fill and compaction activities.
   1. Refer to Section 01 4000, Quality Control Services.

E. Testing Laboratory Qualifications: To qualify for acceptance, geotechnical testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has experience and capability to conduct required field and laboratory geotechnical testing without delaying progress of Work.

1.07 PROJECT CONDITIONS

A. Site Information:
   1. Report available for Contractor's review at Architect's office.
   2. Data on indicated subsurface conditions not intended as representations or warranties of accuracy or continuity between soil borings.
   3. It is expressly understood that Owner not responsible for interpretations or conclusions drawn therefrom by Contractor.
   4. Data made available only for convenience of Contractor.
   5. Additional test borings and other exploratory operations may be performed by Contractor, at Contractor's option; however, no change in the Contract Sum authorized for such additional exploration.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work.
   1. If utilities indicated to remain in place, provide adequate means of support and protection during earthwork operations.
   2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions.
   3. Cooperate with Owner and utility companies in keeping respective services and facilities in operation.
   4. Repair damaged utilities to satisfaction of utility owner.
   5. Provide minimum of 48-hour notice to Architect, and receive written notice to proceed before interrupting any utility.
   6. Demolish and completely remove from site existing underground utilities indicated to be removed.
   7. Coordinate with utility companies for shutoff of services if lines are active.

C. Protection of Persons and Property:
   1. Excavations to comply with applicable safety regulations. ALL excavations to be shored and/or stepped back in accordance with requirements of OSHA and other regulatory agencies.
   2. Barricade open excavations occurring as part of this work and post with warning lights.
   3. Operate warning lights as recommended by authorities having jurisdiction.
   4. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
   5. Perform excavation by hand within dripline of large trees to remain.
      a. Protect root systems from damage or dry out to the greatest extent possible.
      b. Maintain moist condition for root system and cover exposed roots with moistened burlap.

D. Dust Control: Use all means necessary to control dust on and near the work and on or near all off-site borrow areas, if such dust is caused by the Contractor's operation during the performance of the work or resulting from the condition in which the contractor leaves the site.
   1. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public and neighbors.
   2. Dust control measures shall be commence immediately upon the disturbance of soil and shall continue concurrently with work for duration of construction.
   3. Refer to Section 31 2500; Erosion and Sedimentation Control for additional requirements.

E. Conflicts: Immediately repair or replace structures, facilities, and paving damaged through the performance of work under this contract.
   1. Restore damaged materials to condition existing prior to damage in accordance with best standard practices as approved by Architect.
   2. Restoration and repair to be at no additional cost to the contract.

F. Use of Explosives: Use of explosives not permitted.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory soil materials defined as those complying with ASTM D 2487 soil classification groups GC, GW, GP, GM, SC, SM, SW, and SP.

B. Unsatisfactory soil materials defined as those complying with ASTM D 2487 soil classification groups ML, MH, CL, CH, OL, OH, and PT.

C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, and natural or crushed sand.

D. Drainage Fill (under building slab); Provide the following material; Minimum 4" deep:
   1. Clean washed, white river sand conforming with fine aggregate analysis of ASTM C-33.
   2. Clean washed #87 stone.
   3. Approval of material required prior to placement

E. Structural Fill Materials: Comply with the following requirements:
   1. Free of organics, deleterious material, debris, rocks greater than 4".
   2. Any fill within 6" of exposed finish grade to have no rock or gravel larger than 1/2" in any dimension.
   3. Plastic Index: Less than 25.
   4. Liquid Limit: Less than 45.
   5. Standard Proctor Dry Density (ASTM D 698): Minimum 95 psf.
   6. Complying with ASTM D 2487 soil classification groups GC, GW, GP, GM, SC, SM, SW, and SP.
   7. Material shall contain no more than thirty-five percent (35%) by weight finer than No. 200 U.S. Standard Sieve.
   8. Material shall be approved by Geotechnical Testing Laboratory.

F. Pipe Bedding materials – See Trenching Specification.

G. Requirements of Suitable and Unsuitable Soils
   1. For the purposes of this contract, the term ‘unsuitable soils’ shall be defined as being **existing** undisturbed soils which are determined by the testing laboratory to be unsuitable for use as structural fill for reasons other than moisture or water content.
   2. Water saturated soils, regardless of whether water is from above or below ground, shall not be considered as unsuitable. Contractor responsible for dewatering or drying out of water saturated soils to the extent necessary to satisfy the requirements for structural fill.
   3. Fill Material: Fill material placed on site from contractor, regardless of whether fill is on-site or off-site borrow, cannot, by its nature, be classified as unsuitable soils. Only structural, suitable soils to be used for fill.
   4. Materials placed as structural fill shall not be classified as unsuitable soils regardless of conditions encountered.
   5. Water Saturated Soils: Should soils become saturated the contractor shall, as part of the scope of this contract, perform activities necessary to mediate and/or replace water saturated soils as required to obtain suitable structural fill as required by the testing laboratory.

H. Other Materials: the contractor shall provide all other materials not specifically described herein but required for proper completion of the work of this Section.
   1. Material shall be selected by Contractor and approved by Architect.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

3.02 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
   1. All work to be performed in accordance with applicable provisions of the Southern Standard Building Code, OSHA Safety Requirements, State and Local Ordinances and other authorities having jurisdiction
B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
   1. Shore and brace where sloping not possible because of space restrictions or stability of material excavated.
   2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Use of Heavy Equipment
   1. DO NOT use heavy equipment or vibratory equipment adjacent to existing structures or buildings. Contractor shall monitor existing building to ensure no damage is cause by equipment operating near existing structures.

D. Shoring and Bracing:
   1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition.
   2. Maintain shoring and bracing in excavations regardless of time period excavations open.
   3. Extend shoring and bracing as excavation progresses.

3.03 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Soils which are made soft from a lack of dewatering are not considered unsuitable soils. The contractor is responsible for the removal of these soil and replacement with 57 stone under the direction of the geotechnical engineer at no cost to the owner.

C. Do not allow water to accumulate in excavations. Contractor shall provide measures necessary to dewater the site at no additional cost.
   1. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations.
   2. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
   3. Provide temporary storm drainage systems which may include modifying permanent storm drainage structure for temporary use, under drains and holding ponds.
   4. Provide temporary diversion and ditches consisting of moving both wet and dry soil.

D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas.
   1. Do not use trench excavations or as temporary drainage ditches.
   2. Lower and maintain groundwater level min. of 2'-0" below bottom of excavation and ground surface during preparation and compaction of foundation soils and during placement and compaction of fill and backfill.

3.04 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed.
   1. Place, grade, and shape stockpiles for proper drainage.
   2. Locate and retain soil materials away from edge of excavations.
   3. Do not store within drip line of trees indicated to remain.

B. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill. This disposal of soil is not limited to removal from site to landfill or other location. When material is taken off site material becomes responsibility of the contractor.

3.05 PLACEMENT AND COMPACTION

A. Ground Surface Preparation:
   1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.
   2. Remove grass, roots and other vegetation completely.

B. Organic Laden Soils:
   1. Remove all organic ladened soils (top soil) to whatever depth encountered.

C. Proofrolling:
   1. Proofroll building and pavement subgrades with a heavily loaded tandem axle dump truck by systematically traversing site with overlapping passes.
   2. Areas which pump or rut excessively shall be undercut and backfilled or re-worked in place in accordance with recommendations by the testing laboratory.
   3. Proofrolling shall be performed in the presence of a representative of the geo-technical laboratory.

D. Scarify Sub-grade:
   1. After proofrolling and undercutting, scarify top 6" of subgrade.
   2. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

E. Compact Sub-grade:
   1. Moisture-condition cleared, under cut ground surface to optimum moisture content.
   2. Compact subgrade using a non-vibratory roller, to densities indicated below.

F. Verification:
   1. Upon completion of removal of top soil, undercutting, proofrolling, scarifying, and compaction activities, geo-technical lab to inspect conditions and verify that subgrade is suitable for installation of building pad and/or structural fill, as applicable.
   2. Laboratory shall be required to verify soil bearing strength at footing bottom and compaction of top 6" sub grade.
   3. DO NOT proceed until sub grade is found, by testing laboratory and Architect, to be suitable.

G. Back fill:
   1. Place backfill and fill materials in layers max. 8" in loose depth for material compacted by heavy compaction equipment, and max. 6" in loose depth for material compacted by hand-operated tampers.
   2. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content.
   3. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
   4. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

H. Placement of Back fill:
   1. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations.
   2. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

I. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below.
   1. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.

J. Rippable rock Placement:
   1. Ripple rock is considered structural fill and the contractor is required to place as needed to meet the requirements for placement of structural fill.
   2. If necessary the contractor shall reduce the size of the ripple rock to meet requirements for placement of structural fill.

K. Percentage of Maximum Density Requirements: Compact soil to not less than following percentages of maximum density, in accordance with ASTM D 698:
   1. Under structures, building slabs and steps, structure footings and foundations, and pavements, compact top 12" of subgrade and each layer of backfill or fill material to 100% of standard proctor max. dry density. Soil placed below to the top 12”, each layer of backfill or fill material shall be compacted to 98% of standard proctor max. dry density.
   2. Under walkways, curbs and other concrete structures compact top 12" of subgrade and each layer of backfill or fill material to 98% of standard proctor max. dry density.
   3. Under spillways, behind retaining walls, under storm drainage outfall structures and at earthen pond dams (both temporary and permanent) each layer of backfill or fill material to 98% of standard proctor max. dry density.
   4. Under lawn or unpaved areas, compact top 12” of subgrade and each layer of backfill or fill material to 90% of standard proctor max. dry density.

L. Moisture Control:
   1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material.
   2. Apply water in min. quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
   3. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
   4. Stockpile or spread soil material removed because it is too wet to permit compaction.
      a. Assist drying by disking, harrowing, or pulverizing until moisture content reduced to satisfactory value.

3.06 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within tolerance of $\pm$0.10 foot, and extending sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

B. Excavations for footings and foundations:
   1. Do not disturb bottom of excavation.
   2. Excavate by hand to final grade just before concrete reinforcement placed.
   3. Trim bottoms to required lines and grades to leave solid base to receive other work.
   4. Do not allow water to accumulate in bottom of footings and foundations.

C. Compaction of Excavated Areas: Upon completion of footing excavation, loosen exposed soil at footing bottom, and compact to 100% of soil's Standard Proctor maximum dry density.
   1. Compaction to take place prior to placing of reinforcing steel.

D. Maintenance of Excavations:
   1. Clean Footing excavations by removing all foreign materials, loose earth, earth clods or stones.
   2. Remove water softened soil and replace with concrete or structural fill. See dewatering requirements

3.07 EXCAVATION FOR PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.
B. Contractor to excavate until good subbase is obtained.
C. Contractor to add additional graded base course where needed to obtain stabilization.

3.08 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and min. of 6" to 9" of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   2. Do not allow trench excavations to undermine or disturb footings or footing excavations.

C. Where "rock" encountered, carry excavation 6" below required elevation and backfill with 6" layer of crushed stone or gravel prior to installation of pipe.

D. For pipes or conduit less than 6" nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths.
   1. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

E. For pipes and equipment 6" or larger nominal size, shape bottom of trench to fit bottom of pipe for 90^{o} (bottom 1/4 of circumference).
   1. Fill depressions with tamped sand backfill.
   2. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.09 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature less than 35^{o}F.

3.10 BACKFILL AND FILL

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

B. Under grassed areas, use satisfactory excavated or borrow material.

C. Under walks and pavements, use "subbase" material, satisfactory excavated or borrow material, or combination.

D. Under building slabs, use "structural fill" material to within 4" of underside of slab. From this point upward use "drainage fill"

E. Under piping and conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
   1. Shape excavation bottom to fit bottom 90^{o} of cylinder.

F. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and are carried below bottom of such footings or pass under wall footings; place concrete to level of bottom of adjacent footing.
   1. Do not backfill trenches until tests and inspections made and backfilling authorized by Architect.
   2. Use care in backfilling to avoid damage or displacement of pipe systems.
   3. Except as otherwise indicated, top of all piping and conduit 2'-0" min. below finish grade unless encased in concrete.
   4. Where required, concrete encasement to consist of min. of 4" thick concrete base slab placed prior to installation of piping or conduit and min. 4" thick concrete encasement (sides and top) placed after installation and testing of piping or conduit.
      a. Concrete specified in Division 3.

G. Backfill excavations as promptly as work permits, but not until completion of following:
   1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
   2. Inspection, testing, approval, and recording locations of underground utilities performed and recorded.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
   5. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of structure or utilities, or leave in place if required.
   6. Removal of trash and debris from excavation.
   7. Permanent or temporary horizontal bracing in place on horizontally supported walls.

3.11 GRADING

A. General:
   1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
   2. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations indicated, or between such points and existing grades.

B. Grading Outside Building Lines:
   1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
   2. Finish surfaces free from irregular surface changes and as follows:

C. Lawn or Unpaved Areas: Finish areas to receive topsoil to within max. 0.10 foot above or below required subgrade elevations.

D. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface max. 0.10 foot above or below required subgrade elevation.

E. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface max. 0.10 foot above or below required subgrade elevation. When Department of Transportation funding is being used, contractor to grade pavement per DOT standards.

F. Grading Surface of Fill Under Building Slabs:
   1. Grade smooth and even, free of voids, compacted as specified, and to required elevation.
   2. Provide final grades within tolerance of 1/2" when tested with 10 foot straightedge.

G. Compaction: After grading, compact subgrade surfaces to depth and indicated percentage of maximum or relative density for each area classification.

3.12 FINISHED GRADING

A. General:
   1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
   2. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points

where elevations indicated, or between such points and existing grades.

B. Grading Outside Building Lines:
1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding of water at or near perimeter of building.
2. Contractor to remove any material necessary to obtain finish grade 1'-0" below Finish floor.
3. Unless noted otherwise, slope finished grade away building 8" in 10'-0".
4. Finish surfaces free from irregular surface changes and as follows:

C. Distribution of Top Soil:
1. See Section 32 9200 – Lawns and Grassing for more information and details concerning topsoil placement.
2. Topsoil shall be screened mechanically to remove roots, sticks and rocks prior to placement.
3. Distribute stock-piled top soil uniformly across site to a minimum thickness of 4".
4. Provide additional top soil necessary to obtain thickness specified.
5. Grade smooth and even, free of voids, compacted as specified, and to required elevation.
6. Provide final grades within tolerance of 1/2" when tested with 10 foot straightedge.

D. Compaction: After grading, compact subgrade surfaces to depth and indicated percentage of maximum or relative density for each area classification.

E. Temporary Grassing: Apply temporary grassing to all disturbed area and as specified in Section 02370 Erosion, Sedimentation and Pollution Control Plan.

3.13 PAVEMENT SUBBASE COURSE

A. General:
1. Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support pavement base course.
2. Contractor to meet all Department of Transportation standards and requirements for installing subbase.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Shoulders:
~~1.~~ Place shoulders along edges of subbase course to prevent lateral movement.
2. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer.
3. Compact and roll at least 12" width of shoulder simultaneous with compaction and rolling of each layer of subbase course.

D. Placing:
1. Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness.
2. Maintain optimum moisture content for compacting subbase material during placement operations.
3. When compacted subbase course indicated to be 6" thick or less, place material in single layer.
4. When indicated more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.14 PAVEMENT BASE:

A. Pavement base course specified in Section 02743; Bituminous Concrete Paving.

B. The thickness of the pavement and base course specified in Section 32 1216 or shown on drawings. If not indicated, contractor shall assume for purposes of this section the following thicknesses:
1. DOT Pavement (at State Highways): 3" Asphalt; 12" Base
2. Light Duty Pavement (Car Traffic): 2" Asphalt; 6" Base.

3. Heavy Duty Pavement (Bus and Service Drives): 2" Asphalt; 8" Base.

3.15 BUILDING SLAB DRAINAGE COURSE

A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, over subgrade surface to support concrete building slabs.
   1. Drainage course to be minimum of 4" deep unless noted otherwise.

B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness.
   1. Maintain optimum moisture content for compacting material during placement operations.
   2. When compacted drainage course indicated 6" thick or less, place material in single layer.
   3. Compact drainage course with small vibratory base plate or static compactor.

3.16 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work performed.

B. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.
   1. Field density tests may also be performed by nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556.
   2. In conjunction with each density calibration check, check calibration curves furnished with moisture gages in accordance with ASTM D 3017.
   3. If field tests performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by Architect.
   4. Density of Soil In-Place, Drive Cylinder Method, ASTM D 2937.

C. Building Subgrade Area Testing:
   1. Subgrade and Structural Fill:
      a. 1 Test per 3500 S.F. per lift, minimum 5 per lift.
   2. Wall footing Subgrade:
      a. 1 Test per 75 lineal foot of footing; minimum of three.
      b. Perform both Auger and penetrometer tests at each location.
   3. Column Footing Subgrade:
      a. 1 Test for every third footing.
      b. Perform both auger and penetrometer tests.

D. Paved Area Testing:
   1. Subgrade and Structural Fill: 1 Test per 2500 S.F. per lift, minimum two per lift.
   2. Base Course: 1 Test per 2500 S.F., minimum two.
   3. Bituminous Concrete: As required in Section 31 2500.

E. Foundation Wall / Retaining Wall:
   1. Backfill: Perform field density tests 1 Test per 3500 S.F. per lift, minimum 2 per lift.
   2. Wall Footing: 1 Test per 75 lineal foot of footing; minimum of three.

F. If in opinion of Architect, based on testing service reports and inspection, subgrade or fills placed are below specified density, perform additional compaction and testing until specified density obtained.

G. Failure to meet the testing requirements may result in additional testing using alternative testing techniques at no additional cost as directed by Architect.

3.17 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction and Section 31 2500 – Erosion, Sedimentation and Pollution Control Plan.

3.18 MAINTENANCE

A. Protection of Graded Areas:
   1. Protect newly graded areas from traffic and erosion.
   2. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment.
   1. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 EXCESS SOIL AND WASTE MATERIALS

A. Removal to Designated Areas on Owner's Property:
   1. Transport acceptable excess structural fill and topsoil to designated soil storage areas on Owner's property. ALL excess soil on site is property of the owner and shall remain onsite.
   2. Stockpile soil or spread as directed by Architect.

B. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

3.20 UNSUITABLE MATERIAL

A. In the event existing areas of soil cannot be compacted to densities described herein, the contractor shall immediately notify the Architect.
   1. Soil classified as unsuitable due to excessive moisture resulting from improper dewatering practices shall be removed and replaced by the contractor at no cost to the contract.

B. If, in the opinion of the Geo-technical laboratory engineer, Civil engineer, and Architect, the soil is unsuitable and cannot be compacted to the specified densities, the soil shall be removed and replaced with satisfactory material on a unit cost basis, through the issuance of a change order.
   1. Unit Costs shall be included on Contractor's Proposal Form, Section "B". Unit cost for removal and replacement of soil shall include all costs necessary to obtain, place and compact soil to required densities, including, but not limited to:
      a. All materials, labor, equipment, taxes, permits, insurance, bonds, overhead and profit.
      b. Removal and disposal of unsuitable materials.
      c. Borrow, placement and compaction of fill.
      d. Additional soil testing required.
      e. Survey cost for verification of quantities.
   2. Quantities of Materials: Material quantities used to determine payment on the unit-cost basis shall be determined through a mathematical calculation of cross sectional area of soil removed.
      a. A separate calculation for replacement materials shall not be performed. It shall be assumed that the

replacement material quantity equals the removal quantity.

3. Quantity of material removed and replaced shall be verified by a Georgia Licensed Surveyor, retained by the contractor.
   a. The cost for the surveyor's services to be included in the unit cost.

C. Soil removal and replacement shall be observed by the Geo Technical Laboratory's and Architect's representatives.

END OF SECTION 31 2300

SECTION 32 1613

SIDEWALKS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of concrete walks shown on drawings.

1.02 RELATED WORK

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

B. Earthwork and prepared subbase is specified in sections 31 2300.

C. Concrete and related materials as specified sections.

D. Joint Fillers and Sealers are specified sections.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

1.04 SUBMITTALS

A. Submit samples, manufacturer's product data, test reports and material certification as required in referenced sections of concrete work and joint fillers and sealers.

1.05 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
   1. Provide flagmen, barricades, warning signs and warning lights for movement of traffic and cause least interruption of work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms: Steel, wood, or other suitable material 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.
   1. Use flexible spring steel forms or laminated boards to form radius bends as required.
   2. Coat forms with non-staining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded cold-drawn steel wire fabric complying with ASTM A 185.

C. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

D. Expansion Joint Materials: Comply with requirements of Division-7 sections for preformed expansion joint fillers and sealers.

2.02 TRUNCATED DOMES (HANDICAP RAMP)

A. Truncated dome shall installed in sidewalk ramps only at public roads and streets.
B. Unit Pavers Domes shall be precast brick or paver an shall meet the following:
   1. Have compressive strength greater than 8000psi,
   2. Water absorption maximum of 5%
   3. Will meet or exceed ASTM C-936
   4. Freeze-thaw testing per Section 8 of ASTM C-67.
   5. Precast Truncated Domes Meeting ADA Specifications
C. Maximum size shall by 18” x 18”
D. Architect shall determine color. Contractor to provide option of all standard colors including by not limited to Brown, Red, Yellow and Gray.

2.03 CONCRETE MIX, DESIGN AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.
   1. Design mix to produce standard-weight concrete consisting of portland cement, aggregate, air-entraining admixture and water to produce following properties:
      a. Compressive Strength: 3000 psi, minimum at 28 days.
      b. Slump Range: 2" to 4".
      c. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which concrete curbs, walks, and paving to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work.
   1. Do not proceed with work until unsatisfactory conditions corrected in acceptable manner.

3.02 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.
   1. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction.
   2. Do not begin paving work until such conditions corrected and ready to receive paving.

B. Compact sub-base at areas to receive concrete paving and 10'-0" beyond limits of paving as described herein.

C. Compact sub-base to 95% of Standard Proctor Maximum Dry Density (ASTM D698) to a minimum depth of 3'-0".
   1. Compaction shall be accomplished through use of vibratory compaction equipment.
   2. Moisten soil as required to obtained specified densities.

D. Compact surface to 98% of Standard Proctor Maximum Dry Density (ASTM D698).
   1. Compaction shall be accomplished through use of static rolling equipment.
   2. Moisten soil as required to obtained specified densities.

3.03 CONCRETE PADS

A. Place concrete pads at each exterior door where no side walk exists. Pad to be min. 5'-0" deep by the width of the door opening plus 2'-0".

B. Construct concrete equipment pad for each exterior item of equipment, including, but not limited to, HVAC equipment, electrical equipment, transformers, generator, cooler/freezer compressors.

1. Individual equipment pads to be of 6" larger than equipment each direction unless larger pad detailed.
2. Multiple pads adjacent to each other construct a single pad of sufficient size to handle all equipment complying with the following:
    a. Equipment to have a min. of 3'-0" between items of equipment.
    b. Equipment shall be a min. of 3'-0" from face of structure.
    c. Provide a min. of 1'-0" from face of equipment to face of concrete slab.

C. Pad(s) to slope away from the building at 1/8" per foot to drain water.

3.04 CONCRETE SIDEWALKS

A. General:
1. Minimum Thickness of sidewalks shall be 4 inches.
2. Edge of Concrete shall be thickened to 6 inches minimum.
3. Turn down edges shall be install in all locations where sidewalks abut asphalt paving and curbs are not present.
    a. Exposed concrete face shall be 6 inches.
    b. Turndown shall extend to the bottom of the paving section.
4. Concrete shall be thickened to 6” at all locations where sidewalk adjoins or abuts structures, storm structures, and handicap ramps.
5. Finished sidewalk appearance shall be approved by architect.
    a. Cracking, breaks in concrete, pits in concrete surface, and rough finish are not acceptable.

B. Place sidewalks where indicated in drawings.
1. Width of walks to be as shown. If not shown minimum of 5'-0".
2. Longitudinal slope on side walks shall be no more 1:20; unless specifically noted otherwise.
3. Transverse slope shall be 1/8" per foot to drain water away from building; unless noted otherwise.
4. Finished grade on up hill side of walk to be flush with top of walk.

3.05 HANDICAPPED CURB CUTS

A. Provide handicapped curb cuts where indicated on drawings or required herein.

B. Handicapped curb cuts to be constructed in the following locations:
1. Where a perpendicular sidewalk abuts a concrete turn down or concrete curb and gutter at asphalt or concrete pavement.
2. Main entrance to building.
3. Bus loading entrance to building.
4. Handicapped parking spaces
5. Walk to flag pole.

C. Construct handicapped curb cuts in accordance with the applicable details and as follows:
1. In accordance with requirements of agencies having jurisdiction.
2. Width: Min. 5'-0".
3. Depth: 6'-0" for a 6" curb.
4. Slope of ramp and flared edges: Max. 1:12.
5. Tactile Warning Surface:
    a. Public Streets and roadways: Truncated Domes
    b. On project site: Finished Concrete

D. Sample: Prior to constructing handicapped curb cuts or ramps the contractor shall construct a sample curb cut utilizing materials and methods specified for review and approval by the Architect and Agency having jurisdiction.
1. Approved samples may be incorporated into the work.
2. Rejected samples to be removed and reconstructed as directed.

3.06 FORM CONSTRUCTION

A. Set forms to required grades and lines, rigidly braced and secured.
   1. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
   2. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8" in 10'.
      b. Vertical face on longitudinal axis, not more than 1/4" in 10'.

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

3.07 CONCRETE PLACEMENT

A. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.

B. Preparation:
   1. Do not place concrete until subbase and forms checked for line and grade.
   2. Moisten subbase if required to provide uniform dampened condition at time concrete placed.
   3. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Placement:
   1. Place concrete using methods, which prevent segregation of mix.
   2. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator.
   3. Keep vibrator away from joint assemblies, reinforcement or side forms.
   4. Use only square-faced shovels for hand-spreading and consolidation.
   5. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.

3.08 JOINTS

A. General:
   1. Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete, unless otherwise indicated.
   2. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Perimeter Joints:
   1. When walkway abuts existing walks, place transverse joints to align with previously paved joints unless otherwise detailed.

C. Weakened-Plane (Contraction) Joints:
   1. Provide weakened-plane (contraction) joints, sectioning concrete into areas indicated. If not indicated place weakened-plane joints at a maximum spacing of 5'-0" each direction.
   2. Construct weakened-plane joints for depth equal to at least 1/4 concrete thickness, as follows:
   3. Joints to be true and straight, either parallel or perpendicular to side of walk.
   4. Unless otherwise approved in writing by the Architect weakened-plane joints to be tooled type joints. Sawed cut joints of any type are **NOT** acceptable.
      a. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion of slab with recommended cutting tool and finishing edges with jointer.
      b. Sawed Joints: **NOT** accepted.
      c. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove after concrete has hardened.

D. Construction Joints:
   1. Place construction joints at end of all pours and at locations where placement operations stopped for period of more than 1/2-hour, except where such pours terminate at expansion joints.
   2. Construct joints as shown or, if not shown, use standard metal key-way section forms.

E. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
   1. Locate expansion joints at 30' o.c. for each pavement lane, unless otherwise indicated.

   2. Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than l" below finished surface where joint sealer indicated.
   3. If no joint sealer required, place top of joint filler flush with finished concrete surface.

3.09 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating.
   1. Use hand methods only where mechanical floating not possible.
   2. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with 10' straightedge.
   1. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

C. After completion of floating and when excess moisture or surface sheen disappears, complete surface finishing, as follows:
   1. Burlap finish, by dragging seamless strip of damp burlap across concrete, perpendicular to line of traffic; repeat operation to provide gritty texture acceptable to Architect.
   2. Light Broom finish, using a stiff bristle brush place a light broom finish. Deep grooves in sidewalk finish are not permitted. If direction of brush pull is evident, sidewalk will be rejected.

3.10 EXPOSED GRAVEL SURFACE

A. Prior to constructing exposed gravel surface the contractor shall construct a sample curb cut utilizing materials and methods specified for review and approval by the Architect.
   1. Approved samples may be incorporated into the work.
B. Rejected samples to be removed and reconstructed as directed.
C. Exposed gravel to completely fill areas designated.
D. Joints are to be placed prior to placing gravel. Sawed Joints are **NOT** accepted.

3.11 FORM REMOVAL

A. Do not remove forms for 24 hours after concrete placed.
   1. After form removal, clean ends of joints and point-up any minor honeycombed areas.
   2. Remove and replace areas or sections with major defects, as directed by Architect.

3.12 CURING

A. Protect and cure finished concrete paving, complying with applicable requirements of Division 3 sections.
   1. Use moist-curing methods for initial curing whenever possible.

3.13 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete, as directed by Architect.

B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas.
   1. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy resin grout.

C. Protect concrete from damage until acceptance of work.
   1. Exclude traffic from pavement for at least 14 days after placement.
   2. When construction traffic permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

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

END OF SECTION 32 1613

SECTION 32 9200

TURF AND GRASSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections apply to this Section.

B. Excavation, grading and redistribution of top soil part of Section 31 2300, Earthwork.

1.02 DESCRIPTION

A. Section includes furnishing and planting of grass seed, grass plugs and grass sod, including preparation of ground, furnishing and applying mulch, water and fertilizer.

B. Work required under the scope of this section includes, but not strictly limited to:
1. Providing additional top soil necessary to comply with requirements contained in this section.
2. Finished grading to finished contours shown.
3. Incorporation of soil amendments into soil.
4. Planting of sod and plugging, and sowing of seed where indicated.
5. Maintenance of lawns for designated period.

1.03 AREAS TO BE GRASSED- (in this contract)

A. Site shall be stabilized with temporarily grass as soon as grading work that area is complete.
B. Grass with permanent grassing all disturbed areas and areas previously grassed with temporary grassing.
1. All disturbed areas are to be graded, topsoil installed and centipede sod installed.

1.04 SOIL ANALYSIS REPORT

A. Contractor shall obtain soil sample from each of five evenly distributed areas of graded site.
1. Take top soil after top soil distributed and in place at finished grade.
2. Obtain soil analysis and report from Agricultural Extension Service based on each sample.
3. Submit copy of report to Architect who will determine necessary quantity and type of additives necessary to bring soil to satisfactory condition for sustaining grass growth.

B. Materials and quantities listed herein for soil amendment purposes approximately only.
1. Results of soil analysis report to determine actual quantities and types of amendments to be used.
2. Discrepancies between those specified and actual quantities used to be at the expense of the contractor.

1.05 REFERENCES

A. ASAP (American Sod Producers Associates) - Guideline Specifications To Sodding.

B. FS O-F-241-Fertilizers, mixed, commercial.

C. Cooperative Extension Service, The University Of Georgia Bulletin B-773 revised November 1988.

D. Grass seed shall conform to tolerance for germination, purity and weed seed of U.S. Department Of Agriculture Standards.

1.06 DEFINITIONS

A. Weeds: Includes dandelion, jimsonweed, quackgrass, horsetail, morning glory, rush grass, mustard, lambsquarter, chickweed, cress, crabgrass, Canadian thistle, nutgrass, poison oak, blackberry, tansy ragwort, wild bermuda grass, johnson grass, poison ivy, nut sedge, nimbleweed, bindweed, bent grass, wild garlic, perennial sorrel, and brome grass.

1.07 QUALITY ASSURANCE

A. Qualifications of Applicator: Applicator shall be a company regularly engage in commercial grassing contracting, possessing all necessary labor and equipment and has successfully completed a minimum of 5 other project employing the methods specified in this Section and approved by the sod producer.

B. Seed vendor's certified statement for each grass mixture required, stating botanical and common name, percentages by weight, and percentages of purity, germination, and weed seed for each grass seed species.

C. Sod Producer: Company specializing in sod production and harvesting with minimum five (5) years experience and certified by the State Of Georgia.

D. Sod and plug: Minimum age of 24 months, with root development that will support its own weight, without tearing when suspended vertically by handling the upper two corners.
   1. Submit sod verification for grass species and location of sod source.

1.08 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.09 MAINTENANCE DATE

A. Submit maintenance data for continuing Owner maintenance prior to expiration of required maintenance period.

B. Include maintenance instructions, cutting methods and maximum grass height; types; application frequency and recommended coverage of fertilizer and herbicides.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver material to site and protect and store in area designated by the general contractor.

B. Packaged Materials:
   1. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer.
   2. Protect materials from deterioration during delivery, and while stored at site.

C. Store materials in a manner to prevent wetting and/or deterioration.

D. Grass Sod: Cut, deliver, and install grass plugs and sod within 24 hours.
   1. Do not harvest or transport sod when moisture content ma adversely affect sod survival.
   2. Deliver sod on pallets or in rolls.
   3. Protect sod from sun, wind, and dehydration prior to installation.
   4. Protect exposed roots from dehydration.
   5. Protect sod against breaking of rolls.
   6. Do not tear, stretch, or drop sod during handling and installation.

1.11 JOB CONDITIONS

A. The Contractor is advised of the presence of underground utilities. The contractor shall be responsible for verifying location and flagging of all underground utilities prior to the commencement of any work associated with this contract.
   1. Perform work in a manner to avoid possible damage to utilities.
   2. Where necessary hand excavate.

B. The contractor shall be responsible for the repair of damaged utilities, where such damage is a result of work performed under this contract.
   1. Repairs shall utilize materials and methods to match existing construction and shall comply with all applicable codes and regulations.
   2. Repairs shall be at no additional cost to the contract.

C. Excavation: When conditions detrimental to grass growth encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.

1.12 SEQUENCING AND SCHEDULING

A. Immediately after redistribution of top soil and preparation of planting bed, plant trees and shrubs. Plant lawns after trees and shrubs have been planted.

1.13 SPECIAL PROJECT WARRANTIES

A. Warranty lawns through specified lawn maintenance period and until final acceptance of project; whichever is longer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Top Soil:
   1. Top soil shall be fertile, friable, natural loam surface soil reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth.
   2. Obtain top soil from local sources or from areas having similar soil characteristics to that found at project site.
   3. Obtain top soil only from naturally, well-drained sites where top soil occurs in a min. depth of 4".
   4. Do not obtain from bogs or marshes.

B. Commercial Fertilizer:
   1. For lawns, slow release, complete fertilizer, nitrogen content of which derived from organic or inorganic sources, meeting following requirements of plant food by weight, unless soil analysis and report indicate a need for different mixture in which case apply recommended mixture.
   2. Comply with all State and Federal laws relative to fertilizer.
   3. Mixture: 12% nitrogen, 5% Phosphoric Acid, 8% Potash.

C. Ammonium Nitrate:
   1. Commercial product in dry powder form, of recent manufacture, delivered in original, unopened containers bearing manufacturer's guaranteed statement of analysis.
   2. Contain min. 33.5% Nitrogen.

D. Ground Limestone:
   1. Natural ground dolomitic limestone containing min. 85% of total carbonates with min. 30% magnesium carbonates, ground so min. 90% passes 20-mesh sieve and min. 50% passes 100-mesh sieve.
   2. Contractor's option: Slag passing sieve test above.

E. Grass Seed:
1. Delivered to site in original sacks as received from producer, tagged in accordance with agriculture seed laws of the United States and the State of Georgia.
   a. Tag to show dealer's grantee of year grown, percent purity, percent germination and date of tests determining purity and germination.
   b. Required date of test within six months of sowing.
2. Provide fresh, clean, new crop seed complying with tolerance, purity and germination established by Official Seed Analyst of North America.
3. Store seed, delivered prior to use, in manner to protect from damage by heat, moisture, rodents, or other causes.
4. Centipede Grass (Eremochloa Ophiuroides);
   a. Shall contain a minimum of 98% pure seed with 90% minimum germination and a maximum of 0.5% weed seed.
5. Sahara Hulled Bermuda;
   a. Shall contain a minimum of 98% pure seed with 90% minimum germination and a maximum of 0.5% weed seed.
   b. Hulled seeds shall coated with a coating material (clay based) and a fungicide to increase successful germination by providing control of seed and soil borne pathogens.
   c. Sow at the rate of 90 lbs. per acre (hulled)

6. Princess 77 Bermuda;
   a. Shall contain a minimum of 98% pure seed with 90% minimum germination and a maximum of 0.5% weed seed.
   b. Hulled seeds shall coated with a coating material (clay based) and a fungicide to increase successful germination by providing control of seed and soil borne pathogens.
   c. Sow at the rate of
      1) 20 lbs. per acre (hulled)
      2) 20 lbs. acre (un-hulled).

F. Grass Plugs:
1. Cut from Hybrid Bermuda Sod, 'Tift 419' with heavy disc and tractor when sod is moist.
   a. Tag each load of sprigs showing dealer's grantee of percentage purity.
   b. Cut pieces to an average min. 6" X 6"
   c. Keep plugs damp until used.
   d. Keep only as many plugs as can be planted in one day.

G. Grass Sod:
1. ASAP Certified Field Grown Centipede (Eremochloa ophluroides) sod
2. ASAP Certified Field Grown Tiftway (Tifton 419 Bermuda) sod.
3. Min. Two (2) years old, with strong fibrous roots, free of stones, burned or bare spots, and undesirable grasses; containing no more than five (5) weeds per 1,000 square feet, and complying with the following:
4. Machine cut sod and load on pallets in accordance with ASAP guidelines.
5. Machine cut (harvest) sod in areas not exceeding one (1) square yard, to a pad thickness of 3/4" Plus or minus 1/4", excluding top growth and thatch.
6. Provide sod of uniform pad size with maximum 5% deviation either in length or width.
7. Broken pads or pads with uneven end not acceptable.
8. Sod pads incapable of supporting their own weight when suspended vertically with firm grasp on upper 10% of pad will be rejected.

2.02 AUXILIARY MATERIALS

A. Tackifier:
1. Liquid concentrate diluted with water forming a transparent 3-dimensional film like crust permeable to water and air containing no agents toxic to seed germination.

B. Straw Mulch:
   1. Clean oat or wheat straw well seasoned before bailing, free from mature seed-bearing stalks or roots of prohibited or noxious weeds.

C. Wood Cellulose Fiber Mulch:
   1. Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable for hydromulching.

D. Erosion Control Mat:
   1. Provide slope mats where indicated. If none are indicated provide for all slopes with a gradient greater than 3:1. Mat shall consist of 100% biodegradable material and be designed for a velocity of 15 fps. Mat is to be installed parallel with the slope. Additional requirements are as follows:
      a. Material: Wood or Straw
      b. Thickness: Minimum of ½”
      c. Netting: Minimum size of ½” x ½” on both sides
      d. Staking: Minimum of four hard wood stakes per 20’-0” length. Additional stakes may be required to meet manufactures specifications

E. Water:
   1. Clean, fresh and free of oil, acid, alkali, salt or other substances or matter, which could inhibit vigorous growth of grass.

PART 3 - EXECUTION

3.01 GENERAL

A. It is the intent of these documents that the entire site, excluding areas on which building, paving and/or walks are to be placed, is to be grassed.
   1. Provide grass sod where indicated.
   2. Areas not specifically designated to receive grass sod or plugs are to be seeded.

B. Except where specifically noted otherwise, contractor shall have the option of grassing site using seed, plugs or sod or any combination of seeding methods specified.

C. Regardless of grassing method chosen acceptance of site subject to conditions stated below.

3.02 INSPECTION

A. Verify that prepared soil base is ready to receive the work of this section. Notify Architect.

B. Examine finish surfaces, grades, and topsoil quality and topsoil depth for suitability. Notify contractor of unsuitable conditions. Do not commence work until unsatisfactory conditions corrected.

C. Beginning of installation means acceptance of existing site conditions as being acceptable for the performance of work herein specified.

3.03 REDISTRIBUTION OF TOP SOIL

A. Contractor redistribute existing topsoil across all areas of site where not indicated covered by building, pavement or other improvement.

B. Topsoil currently stock piled on site; redistribute as to provide a minimum average depth of top soil of 4".

C. Determine thickness of topsoil available. If thickness less than 4" provide additional top soil necessary to achieve an

average min. thickness of 4".

D. Topsoil shall be mechanically screened to remove organic material prior to placement.

3.04 PREPARATION FOR PLANTING LAWNS

A. Top soil preparation: Prior to mixing or fertilizing, remove roots, plants, stones, clay lumps and extraneous materials from top soil.
   1. Loosen topsoil to min. depth of 4".
   2. Remove stones measuring over 1 inch in any dimension.
   3. Remove sticks, roots, rubbish, and other extraneous matter.
   4. Limit preparation to areas planted promptly after preparation.

B. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture.
   1. Roll, rake, and drag lawn areas, remove ridges and fill depressions, required to meet finish grades and as required to drain.
   2. Limit fine grading to areas planted immediately after grading.
   3. Where sod indicated to be installed allow for sod thickness.

C. Moisten prepared lawn areas before planting if soil dry.
   1. Water thoroughly and allow surface moisture to dry before planting lawns.
   2. Do not create a muddy soil condition.

D. Restore lawn areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting.

E. Before sowing grassing operations commence, loosen soil to a min. 12" depth using 'Knife Point Type Sub-Soiler attachment (max. 8" o.c. spacing of tines).
   1. Prepare bed by thoroughly cultivating, discing, hand raking, etc, as necessary to produce smooth even grade free of hollows and other inequalities.

3.05 FERTILIZING AND LIMING

A. General: Apply fertilizer in accordance with manufacturer's instructions but in no case less than the amounts listed herein.
   1. Apply specified commercial fertilizer at rates indicated and thoroughly mix into upper 4 inches of topsoil.
   2. Delay application of fertilizer if lawn planting will not follow within a few days.

B. Liming: Approximately two days prior to the start of grassing operations apply ground limestone or slag at the rate of 100 lbs/1000 s.f. of lawn area.
   1. Work lime into top 6" of ground.

C. Initial Fertilization: Either in conjunction with application of lime, or immediately after, apply specified commercial fertilizer aver lawn areas at the rate of 50 lbs./1000 s.f..
   1. Work fertilizer into top 4" of ground.
   2. Apply after smooth raking of soil and prior to installation of seed, plugs or sod.
   3. Apply fertilizer no more than forty-eight (48) hours before laying seed, plugs or sod.

D. Additional Fertilizations: Three to four weeks after planting or after germination, apply 1.25 lbs. of nitrogen (4 lbs. of ammonium nitrate) per 1,000 square feet to grassed area.
   1. Repeat ammonium nitrate every three to four weeks until mid August.
   2. Mid-August to early September a complete fertilizer such as used for the initial fertilization shall be installed to promote root growth throughout the winter.

3.06 EROSION CONTROL MAT

A. Install erosion control mat on earthen slopes where slope exceeds 3:1 (3 feet horizontal for 1 foot vertically).
   1. Installation to be in accordance with manufacturers written instructions.

3.07 SEEDING

A. Seed all areas disturbed as a result of construction operations unless area indicated to be grassed with plugs or sod, or unless area to be covered with paving or building.

B. Do not use wet seed or moldy seed or otherwise damaged in transit or storage.

C. Do not seed when wind velocity exceeds 5 miles per hour or when poor results obtained due to adverse soil or weather conditions.

D. Sow grass seed evenly by hand or mechanical broadcast in two operations in equal amounts, at right angles to each other.
   1. After sowing seed lightly rake or drag, either by hand or mechanical equipment, to cover seed to a maximum depth of 1/4".
   2. Immediately after seeding water areas seeded with fine spray.

E. Sow not less than quantity of seed specified or scheduled.
   1. Centipede: 25# to 40# Per Acre.
   2. Princess 77 hulled bermuda: 4 lbs. per 1,000 square feet.
   3. Princess 77 unhulled bermuda: 5 lbs. per 1,000 square feet.
   4. Sahara hulled bermuda: 2 lb. per 1,000 square feet.

F. Protect seeded areas against erosion by spreading specified lawn mulch after completion of seeding operations.
   1. Spread uniformly to form a continuous blanket not less than 1-1/2" loose measurement over seeded areas.
   2. Anchor mulch by spraying with asphalt emulsion at the rate of 10 to 13 gallons per 1000 sq. ft.
   3. Take precautions to prevent damage or staining of construction or other plantings adjacent to mulched areas.

3.08 PLUGGING

A. All work to be in accordance with recommendations provided by the Cooperative Extension Service, The University Of Georgia Bulletin 773, revised November 1988.

B. Areas to be plugged to be prepared in the same manner as specified for sodding and as recommended by supplier.

C. Plug area designated on drawing using 2" plugs of grass of type indicated planted at 6" to 8" on center each was to a depth of 1" to 2".

D. After placing the plugs in furrow, cover part of plug with soil and compact using a roller. Commence watering of plugs immediately.

E. Maintain plugs as described for sod.

3.09 LAYING SOD

A. Allow for sod thickness in areas to be sodded.

B. Roll areas to receive sod prior to placing sod and after sod has been laid with a roller with a minimum weight of 200 lbs

C. Lay Sod within 24 hours from time of stripping.
   1. Do not plant dormant sod or if ground is dormant.

D. Lay sod to form a smooth solid mass with tightly fitted joints complying with the following:
   1. Butt ends and sides of sod strips; do not overlap.
   2. Stagger strips to offset joints in adjacent courses.
   3. Work from boards to avoid damage to subgrade or sod.
   4. Tamp or roll lightly to ensure contact with subgrade.
   5. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
   6. Anchor sod on slopes with wood pegs to prevent slippage.
   7. Netting on sod should be removed before installation.

E. Water sod thoroughly with a fine spray immediately after planting.

F. After sod and soil has dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with roller not exceeding thirty (30) gallons.

G. Protect sodded areas against erosion with erosion control mat or other methods acceptable to the Architect.
   1. Install erosion control mat in accordance with manufacturers recommendations.

3.10 MULCHING

A. Place straw mulch on seeded areas within 24 hours after seeding.

B. Place straw mulch uniformly in continuous loose (not matted) blanket at the rate of 2-1/2 tons per acre, or (2) 50 pound bales per 1,000 square feet of area.
   1. A mechanical blower may be used for straw mulch application when acceptable to Architect.

C. Crimp straw into soil by mechanical means.

D. Anchor straw mulch with asphaltic emulsion binder applied uniformly at the rate of not less than 100 gallons per acre for erosion prone areas.

E. Protect buildings, paving, plantings, and all non-seeded areas from asphaltic emulsion over-spray.

F. Provide straw bale checking in ditches or problem swales at intervals required to adequately slow water velocity and impede soil loss.

3.11 WATERING

A. General: Watering is the contractor’s responsibility until grass is accepted by the architect.
   1. Contractor to provide all watering materials to include but not limited to hoses, sprayers, piping, and timers.
   2. If irrigation is installed as part of the contract, the contractor shall operate and maintain the irrigation system until grass is established.

B. Soak mulch and seed bed to a min. depth of 6"; 4" for plugs and sod immediately after grassing.

C. Water lawns daily to maintain adequate surface soil moisture for proper seed germination.
   1. Continue daily watering for not less than 30 days.
   2. Thereafter apply 1/2" of water twice weekly until acceptance.
   3. Use only fine spray nozzles.
   4. Do not wash away soil, seed, plugs, or sod.

3.12 MAINTENANCE

A. Maintenance shall consist of watering, weeding, fertilizing, liming, weeding, disease and insect pest control, mowing, protective spraying, replacement of unacceptable material, and any other procedure consistent to insure normal, horticultural practice necessary to insure normal, vigorous, and healthy growth of all work.

B. Maintenance shall begin immediately after each portion of grass is installed and shall continue until acceptance.

C. Maintain lawns for not less than the period stated below, and longer as required to establish an acceptable lawn.
   1. Seeded and plugged lawns, not less than 120 days after substantial coverage is obtained.
   2. If seeded or plugged in fall and not given full 120 days of maintenance, or if not considered acceptable at that time, continue maintenance following spring until acceptable lawn established.
   3. Sodded lawns, not less than 120 days after substantial coverage is obtained.

D. Mowing Grass: Mow lawn areas as soon as lawn top growth reaches a 3" height. Mow grass at regular intervals to maintain at a maximum height of 2". Do not cut more than one-third (1/3) of grass blade at any one mowing. Mowing shall be done at a minimum of once every two weeks during the maintenance period.
   1. Neatly trim edges and hand clip where necessary.
   2. Immediately remove clippings after mowing and trimming.

E. Weeding: Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy and damage resulting from improper use of herbicides.

F. Lawn Establishment:
   1. Roll surface to remove minor depressions or irregularities.
   2. Immediately replace areas which show deterioration or bare spots.
   3. Re-grade and re-seed washed areas or eroded areas as required until a suitable ground cover is obtained.
   4. The contractor shall be responsible for all damages to the lawn areas during the maintenance period.

3.13 PLANTING SEASON

A. Perform seeding between August 15 and October 15 or between May 1 and June 1 or during season or seasons normal for such work as determined by weather conditions and accepted practice in locality.

B. Perform plugging and sodding only in seasons from May 1 and September 1; if seasonal or other conditions permit, and with written approval by the Architect, start grassing activities earlier and/or continue later than specified dates.

C. Temporary vegetative cover required if seasonal requirements for planting not correct at time grading operation complete.
   1. Seed annual rye grass at rate of 3 bu/acre.
   2. Perform seeding in manner outlined in this section.
   3. Before permanent grassing begun, Contractor shall restore and prepare ground surface as required by this section.

3.14 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers.
   1. Maintain protection during installation and maintenance periods.
   2. Treat, repair, or replace damaged landscape work as directed.

3. Immediately repair eroded or damaged areas, regardless of cause, by reseeding, plugging or sodding as required.

3.15 INSPECTION AND ACCEPTANCE

A. When landscape work completed, including maintenance, Architect will, upon request, make inspection to determine acceptability.
   1. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Architect and found acceptable.
   2. Remove rejected materials promptly from project site.

B. Conditions for Acceptance for areas sodded, plugged and seeded.
   1. Architect has issued a final certificate of completion for the entire project.
   2. Grass shall exhibit vigorous growth.
   3. Grass shall be mowed by contractor a minimum of three (3) times. Last mowing shall be within seven (7) days prior to final inspection.
   4. Maximum weed or foreign grass count shall not exceed 50 weeds or foreign grass per 100 sq. ft.
   5. No erosion shall exist.
   6. Stand of grass:
      a. Seeded: 75% coverage of growing viable grass with no bare spots over one square foot in size.
      b. Plug: 75% coverage of growing viable grass with no bare spots over 3" in size.
      c. Sod: 100% covering of growing viable sod, with no bare spots over 3" in size.

END SECTION 32 9200